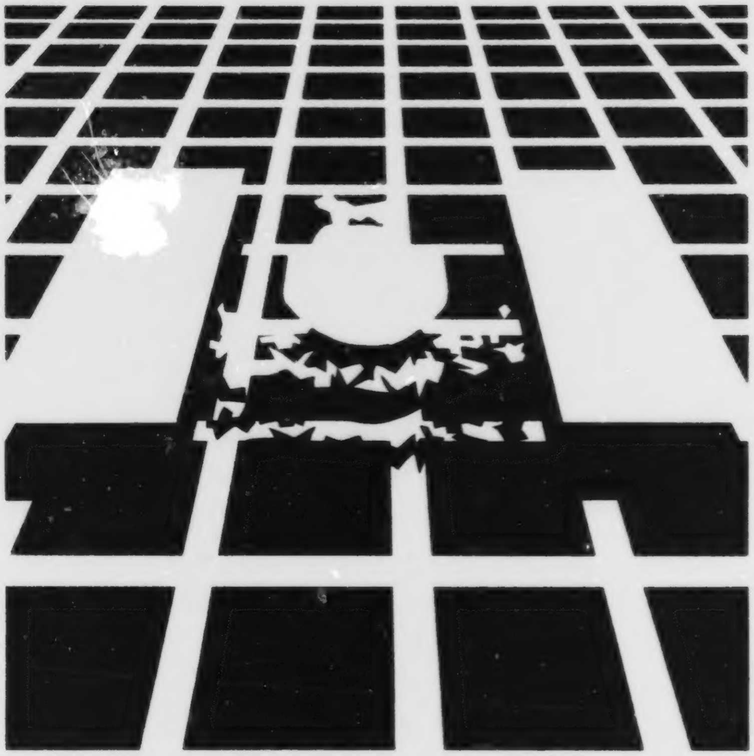
INPUT - OUTPUT TABLE FOR YUKON

Vol. 1



YUKON
RIVER
BASIN
STUDY

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The views, conclusions and recommendations contained herein are those of the author and are not necessarily those of the Yukon River Basin Committee or those of the Governments of Canada, British Columbia and Yukon.

prepared for the

Northern Economic Planning Branch of
The Department of Indian and Northern Affairs,
The Yukon Department of Economic Development

and

The Yukon River Basin Committee

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INPUT-OUTPUT FOR YUKON
AND
YUKON RIVER BASIN

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INPUT-OUTPUT FOR THE YUKON

EXECUTIVE SUMMARY

In modern complex economies there is a major interest in the interactions among the various sectors of economic activity. One of the most comprehensive techniques which has been developed, both to portray these interactions and to analyze the implications of them, is the input-output technique. An input-output table shows how the output of each industry is distributed to other industries and to each category of final demand. The table also identifies each industry's source of inputs both from other industries and from the primary inputs (or final payments) categories. Although interesting as a descriptive devise its primary use is analytical. For example, with the aid of an input-output table it is possible to derive sectoral multipliers. More importantly, it can be used in economic growth scenario testing or in making projections concerning the magnitude of economic interactions required to support any assumed level or configuration of final demands.

This report describes an input-output table for Yukon produced for the Federal Department of Indian Affairs and Northern Development, Northern Economic Planning Branch, Yukon Department of Economic Development and Intergovernmental Relations and for the Yukon River Basin Study. It also describes the input-output table for the Yukon River Basin.

In January 1982, a report entitled "INPUT-OUTPUT FOR THE YUKON AND THE NWT" was submitted to these agences in which we identified the possibility of constructing an input-output table for Yukon with an interindustry transactions matrix of from ten to twelve sectors. Secondary or published data appeared to be sufficient to construct the final demand columns and final payments rows but very little data was available regarding interindustry transactions. An interview and questionnaire approach was therefore adopted to obtain information from business firms in Yukon regarding interindustry transactions.

The tables produced with this information turned out to be somewhat larger than what was initially envisaged, with an interindustry transaction matrix of thirteen sectors. These are:

1. Hardrock Mining
2. Placer Mining
3. Oil and Gas
4. Forestry
5. Hunting, Trapping, Fishing and Subsistence
6. Transportation
7. Construction
8. Utilities including Communications
9. Wholesale Trade
10. Retail Trade
11. Services
12. Finance, Insurance and Real Estate (F.I.R.E.)
13. Manufacturing

This somewhat larger number of sectors was achieved by obtaining first hand information from firms in these sectors and using it as a supplement or to assist in disaggregating the secondary information which was sometimes available wholly or partly in a more aggregate form. In this manner F.I.R.E., Wholesale Trade and Retail Trade were disaggregated from Services and Trade. Placer Mining was created by collecting a substantial amount of information directly from the Placer Mining industry and supplemented with secondary information obtained from government records of output in this industry.

The resultant Yukon and Yukon River Basin tables are largely self-explanatory. However, a few comments may assist in interpreting them.

The Yukon and Yukon River Basin tables, like the one for the Canadian economy, are constructed on a "gross domestic product" basis. Under this approach the boundaries of production are confined to Yukon irrespective of whether the factors of production are Yukon or non-resident. This contrasts with the "gross territorial product" approach in which the boundaries of production are drawn to include all of the output of Yukon factors of production irrespective of where the production originates.

The Hard Rock Mining sector, sometimes popularly identified as the backbone of the Yukon economy, is certainly the most important of the private sector export industries. In the year for which the basic table was constructed, 1978, exports of the Hard Rock Mining industry accounted for 76 percent of total Yukon exports.

No separate "tourism" industry is identified although it is known to be an important source of income for the Yukon economy. This is because a common set of inputs from the service and trade industries is used to produce outputs which are sold to both residents and tourists. A distinction is made, however, between the sale of output to residents and tourists. The latter appear as export sales from the retail trade sector (row 10, column 16) and from the services sector (row 11, column 16). These tourism dollars accounted for an additional 18.7 percent of Yukon exports in 1978 as shown on Table 4 which is used as the general reference throughout the text.

Government is an unusually important activity in the Yukon. Measured in terms of direct payments to households in the form of labour income, the combined payroll of all levels of government was larger than any of the producing sectors and was 36 percent larger than the payroll of the Hard Rock Mining industry in 1978. Measured in terms of total final payments less imports, however, the Hard Rock Mining sector was 43 percent larger than government. These two activities clearly dominate the economy regardless of ranking and together accounted for 48 percent of all labour income.

All traditional activity (hunting, trapping, fishing and subsistence) has been combined into a single sector because as in the case of tourism, a common, or at least overlapping, set of inputs is used to produce food for subsistence and products (such as furs) for sale. Eighty percent of the output of this sector was calculated to consist of subsistence which was allocated to consumption (row 5, column 19). Exports of saleable products are identified in row 5, column 16. All supplies were considered to be purchased from retail trade (row 10, column 5). Finally, people engaged in this activity were considered to be more like individual proprietors than hired labour and all income including income-in-kind, was allocated to the net income of unincorporated business (row 18, column 5).

The basic Yukon table was constructed for the year 1978. This was the last year for which a nearly complete set of high quality officially compiled data and secondary information was available. Most of the entries in the final demand columns and final payments rows were constructed based on this information. In some cases, as explained below, distributions of aggregate data were obtained from supplementary sources. Data for the interindustry transactions matrix for the year 1981 was obtained primarily from questionnaires and interviews during the summer and fall of 1982.

From the table of transactions in dollar values the direct coefficient matrix and the direct-plus-indirect coefficient matrices (one with households endogenous, the other with households exogenous) were derived.

The 1978 Yukon River Basin table was derived from the 1978 Yukon table by making a number of adjustments. The Oil and Gas sector was eliminated. The Forestry sector was reduced to reflect the proportion of that activity conducted in the Yukon River Basin. All of the Hard Rock Mining and the Hunting, Fishing, and Trapping sectors were allocated to the Yukon River Basin. Placer mining output in the British Columbia portion of the basin was added to the Yukon total for that industry. Other sectors were scaled down by adjusting individual total gross output figures according to the proportion of firms located in the Yukon River Basin. The direct and the direct-plus-indirect coefficient matrices were then derived for the Yukon River Basin from this table of absolute values.

The 1981 Yukon and Yukon River Basin tables were obtained by multiplying the known and estimated final demands for 1981 by the 1978 direct-plus-indirect coefficient matrices. Final demands for the Mining sectors were known. All other final demands were derived from information provided by the Department of Economic Development, Government of Yukon.

In the following sections more detailed descriptions of assumptions, procedures and uses of the tables are provided.

II. INTRODUCTION

A. OBJECTIVE OF OVERALL STUDY

1. Overview

This report describes the input-output tables for Yukon produced for the Federal Department of Indian Affairs and Northern Development, Northern Economic Planning Branch, Yukon Department of Economic Development and Intergovernmental Relations and for the Yukon River Basin Study. It also describes the adjustments made to the Yukon input-output tables and the resulting tables for the Yukon River Basin.

In completing the project, two primary objectives were to be met. In the first case the Yukon input-output model was to "provide quantitative information on the internal structure of the Yukon economy, its structure, functioning and relationship to external economies in a format that permits the use of this information by senior management in policy formulation." [1] In the second case the Yukon and Yukon River Basin input-output models were, from the perspective of the Yukon River Basin Study, " ... intended to develop a theoretical framework for an input-output model and to prepare input/output tables for Yukon and the Yukon River Basin." [2]

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[1] DIAND: Service contract dated June 30, 1981, p.1.

[2] Canada - British Columbia - Yukon: Yukon River Basin Study Agreement Project Approval, Project Description Section, June 19, 1981.

2. Project Stages

The project was completed in three stages which, while conceptually distinct, overlapped in execution.

The first of these stages involved the gathering and evaluation of existing information, both published and unpublished. The evaluation consisted, first, of determining whether the existing data would support the development of all or part of an input-output framework which would meet the basic objectives referenced above. The evaluation also identified the nature of constraints imposed on the development of the framework by the aggregation, amount or quality of existing data. The data gathered consisted of the Economic Accounts, the Territorial Accounts, the Price-Waterhouse surveys of the mining industry, the Census, other input-output tables and, most importantly, the worksheets that had been used to construct the Economic Accounts.

Our evaluation and recommendations regarding the nature of the framework the data would support were set out in a document entitled "Input-Output For the Yukon and The NWT" dated January 1982. A copy of this report was provided to the Yukon Department of Economic Development and Intergovernmental Relations and formed the basis for discussion (in Whitehorse on January 26, 1982) of their desires regarding, in particular, the dimensions of the input-output framework needed for the Yukon River Basin Study. In general, tables of greater dimensions than what was recommended in our report to DIAND were desired for the study. It was agreed that more sectors would be provided and the initial agreement was subsequently modified to reflect this desire. It particularly was agreed to separate the mining sector into "Placer" and "Hard Rock" mining, to separate "Trade" into "Wholesale" and "Retail Trade" and to provide for a separate sector for the "Finance, Insurance and Real Estate" industry. It was originally envisaged that 1981 data obtained from questionnaires distributed in 1982 would form the primary date source and that the 1978 information from DIAND would be used for the final payments and final demand distributions only. However, it turned out that the quality of the questionnaire data was insufficient for this purpose. Thus the 1978 data became the primary data source and the basic transactions table was for 1978. (See section III.C.2. for a detailed discussion.) A 1982 transactions table was subsequently produced from the model derived from the 1978 table as explained in section III.C.4.

The second stage involved collection of data on interindustry transactions and the actual construction of the input-output tables. The available data, collected in the first stage, was rearranged and recombined to accomodate the informational classifications of the input-output framework as opposed to the (territorial) income accounting or other systems for which the various data had been originally compiled. From this data the final demand columns and final payments rows of a Yukon table were eventually constructed for the year 1978. This was the latest year for which the most comprehensive body of information, the worksheets for the Economic Accounts, was available. Also in this stage, questionnaires were developed for circulation to Yukon business firms. These questionnaires were designed primarily to obtain information on interindustry transactions for 1981 which were not otherwise available. During the summer of 1982 interviews were held with the 15 largest economic entities in the Yukon. Following this, questionnaires were sent, or distributed through associations, to several hundred additional business firms in the Territory and some additional interviews were held with smaller firms. Evaluation, and interpretation of the information obtained from the questionnaires and reconciliation of this with the data used to construct the final demand rows and final payments columns resulted in completion of the 1978 and 1981 Yukon and Yukon River Basin tables.

A 35 page report entitled "Input-Output For the Yukon" and a 129 page report entitled "Yukon Input-Output Computer Programs" were provided, along with other materials particular to the DIAND contract, to the Department of Indian Affairs and Northern Development in February of 1983 and were accepted as satisfying their major Project Requirements. The same documents were provided the Yukon Department of Economic Development and Intergovernmental Relations and formed the basis for discussions on how these documents could be modified to meet their requirements. This and the accompanying document entitled "Yukon Input-Output Computer Programs, November 1983", represent the results of that process.

B. MAJOR ELEMENTS IN THE REPORT

The remainder of the report is divided into two major sections. In section III, a detailed description of how the input-output tables were created is developed. Section IV discusses some applications of input-output and the derivation and uses of multipliers.

More specifically, the theoretical basis of input-output economics is discussed in part A of section III. The development of a model specifically for the Yukon is discussed in part B of section III in the context of both theoretical considerations and practical constraints imposed by data availability, quality or form. The development of an energy component for use in conjunction with the input-output models is also described in this part. Part C of section III is, in a sense, an extension, at a detailed level, of the discussion conducted at a general level in part B. In Part C, subsection 1, the specifics, as they relate to particular rows or columns of the various tables are developed and the relationship between the 1978 and 1981 tables is explained. How the household sector is endogenized, and why, is explained and the development of imports as a row versus a column is discussed. In subsection 2 the development of individual cells from the basic data sources is outlined on a step by step basis. In subsection 3, the transactions table, the direct coefficients table and the direct plus indirect coefficients tables are presented. Comments on stability conditions, internal consistency checks and some cells of interest follow in subsection 4. In part D of section III the methodology used and additional data sources required in preparing the Yukon River Basin tables are explained. Finally, in part E of section III the technique and data sources employed in the creation of the Placer Mining sector are discussed.

Although the applications of input-output are addressed in the theoretical discussion of part A of section III and elsewhere in the text more specific observations are provided in section IV. A specific example of a hypothetical change in the magnitude and composition of final demand is developed. Interpretations and precautions associated with the use of input-output as a tool for forecasting are pointed out. Finally the output and income multipliers, which derive from the Yukon and Yukon River Basin models, are developed and explained in part B of section IV.

III. INPUT-OUTPUT ANALYSIS

A. THE THEORETICAL INPUT-OUTPUT MODEL

1. The Input-Output Accounting Framework[3]

An input-output table fulfils two separate functions. First, it is a descriptive framework for showing the relationship between sectors (industries) in an economy and between inputs and outputs of specific sectors. Second, it is an analytical tool for measuring the impact of autonomous distrubances on an economy's output and income. A set of input-output accounts is, first and foremost, a mode of description. If data are available or collected to set down the economic interrelationships of an area in input-output form, then the resulting accounts will be useful for demonstration and consistency-checking purposes. In this regard input-output accounts are similar to income accounts. The input-output accounts are more comprehensive, however, in that input-output accounts break down the business sector into a large number of individual industries or sectors and record the transactions that flow between each sector. These intersectoral flows are shown as an interindustry transactions matrix in the account.

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[3] This section (III.A.1) draws on material found in Walter Isard, et. al., Methods of Regional Analysis. New York, John Wiley & Sons, 1960, chapter 8. William Miernyk, The Elements of Input-Output Analysis. New York, Random House, 1965, chapter 2; and H.W. Richardson, Input-Output and Regional Economics. New York, John Wiley & Sons, 1972, chapter 2.

Apart from this, an input-output account contains more or less the same kind of information found in national (or regional) income accounts, though sometimes in a slightly different form. For instance, the major components of Gross National Product (GNP) or Gross Regional Product (GRP), as estimated by the expenditure and income methods, are usually both obtainable from an input-output table. The final demand segment of an input-output table usually divides final goods and services into the same expenditure categories (consumption, investment, government and exports) as are found in national accounts. Similarly, the value-added rows of an input-output table may consist of entries (wages, profit, interest and rent) similar to those used in the factor incomes approach to the measurement of GNP or GRP although the terminology may differ such as Labour Income, Net Income of Unincorporated Business, Other Operating Surplus, etc.

Since most of the information found in basic income accounts is also required in input-output accounts, the latter provides a much more comprehensive accounting framework. Income accounts, on the other hand, are unable to show all the changes observable in an input-output table. For instance, shifts in demand from one commodity to another would go unnoticed in an income accounting scheme if total consumption remained constant; however such shifts would be revealed in an appropriately disaggregated input-output account. This is not merely a question of factual detail since relative demand shifts within a constant expenditure total can have extensive repercussions on total output via changes in interindustry transactions; these can only be observed in an input-output framework. Although input-output accounts can be made consistent with income accounts, their emphasis is different. The dominant concern of income accounts is the total magnitude of GNP or GRP and the composition of final demand, while input-output accounts focus more on the interindustry transactions that lie behind changes in final demand. This distinction between the income and the input-output accounting systems carries over to comparisons between income determination models and input-output models. Changes in composition of consumption expenditure within an income determination model will typically generate a much less pronounced impact throughout the rest of the economy than would be observed with an input-output model.

This difference in emphasis not only reflects a difference in appearance and layout between the two forms of account but, even more, is explained by the use made of input-output models. At this point, the distinction between the descriptive accounting framework and the operational tool of analysis becomes blurred. The design of input-output accounts divides the economic structure of the economy into endogenous and exogenous sectors, somewhat analogous to the distinction between 'autonomous' and 'induced' elements in income determination theory. However, the latter is not shown in a set of income accounts, whereas the endogenous (the intersectoral matrix) and the exogenous portions of the input-output table are clearly separated. This sharp division identifies another advantage of input-output over income accounts. The endogenous-exogenous distinction is revealed in the division of outputs into two categories, intermediate and final demand, and of inputs into 'produced' and 'primary' (e.g. labour, capital). These divisions enable the analyst, when the table is used as a tool rather than merely an account, to work out the effects of an exogenous disturbance, i.e. a change in final demand, on interindustry transactions and hence on total production in each sector of the economy.

As the above remarks suggest, the utility of regional input-output accounts extend from the more basic descriptive purposes of any accounting system to the practical applicatons of an input-output model. Since an input-output table is in itself an accounting system, the prior existence of a table is obviously necessary for input-output analysis. In addition to its usefulness as a descriptive devise, the table can be used for consistency checking. However, as a model of the economy, its greatest usefulness is in impact evaluation.

In the development of an input-output accounting framework, consistency checks must be made and these checks take many forms: checks on both sides of a single interindustry transaction flow, i.e. that the sales of industry i to industry j are consistent with industry j's estimate of purchases for i; summing the sales (or purchases) of industry i to (or from) all other sectors and to final demand (or from primary inputs) and checking these against industry i's total sales (or purchases), especially if independent estimates of industrial output are available; balancing the inputs and outputs of each sector, i.e. checking their column and row sums; and, the overall balance of the input-output account, i.e. the identity of value added (gross regional income) and local final demand plus net exports (gross regional product). Internal and external consistency are aided by comprehensiveness and by comparability with the accounts for other regions and by national-regional comparisons.

Figure 1 represents an input-output transactions (or gross flows) table. Although the table is in simplified form with certain entries aggregated and certain minor transactions omitted, it is useful for demonstrating key accounting identities. These are obtained by summing across the rows and down the columns. For instance, row i in the table shows the sales of industry i to all other industries (intermediate demand) and to consumption, private investment, government spending and exports (which are the components of final demand); intermediate demand plus final demand measures total gross output (or sales) of industry i. Thus in a n sector model:

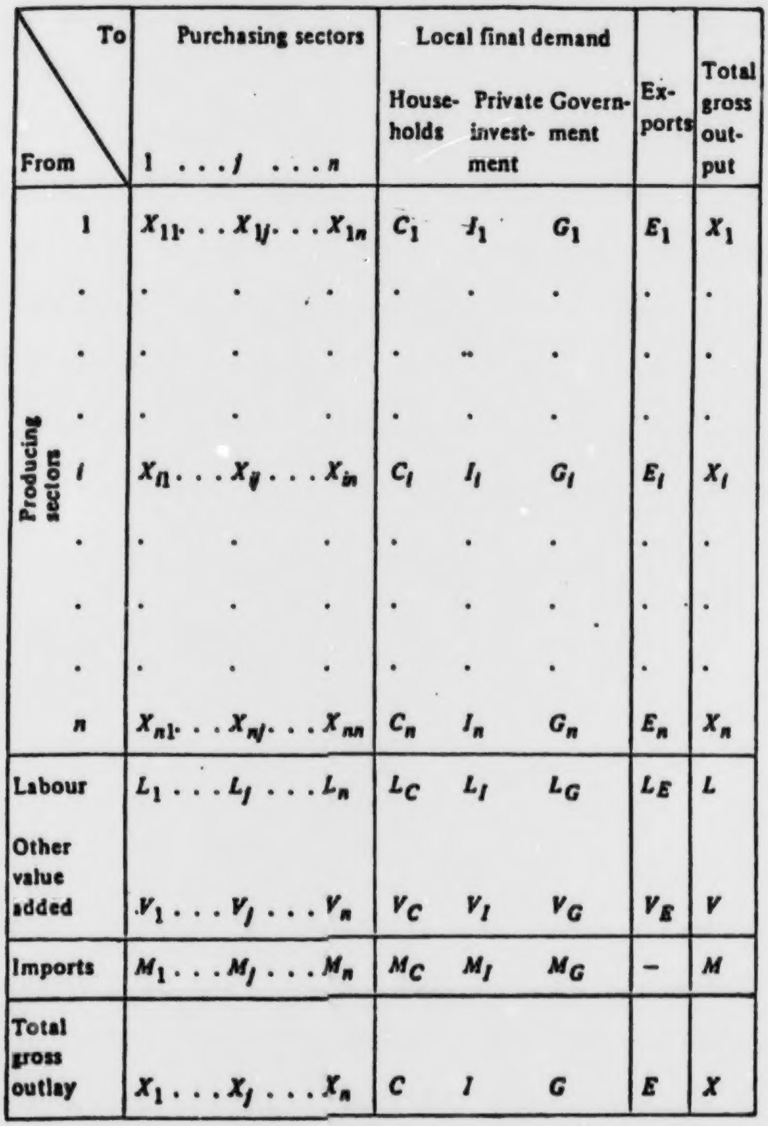
$$X_i = \sum_{j}^{n} X_{ij} + (C_i + I_i + G_i + E_i) \qquad \text{III.1}$$

$$\underset{\text{output}}{\text{Gross}} = \underset{\text{demand}}{\text{Intermediate}} + \underset{\text{demand}}{\text{Final}}$$

Conversely, column j shows the purchases of industry j from all other industries (intermediate inputs), from primary inputs (labour, capital, etc.) which are value added entries taking the form of wages, profit, rent, interest and taxes, and from imports. In the table, value added is disaggregated into two components only: payments to labour and all other payments. Summing down column j yields

$$X_j = \sum_{i}^{n} X_{ij} + L_j + V_j + M_j \qquad \text{III.2}$$

Fig. 1 Simplified, input-output transactions table



From \ To		Purchasing sectors	Local final demand			Exports	Total gross output
		$1 \ldots j \ldots n$	Households	Private investment	Government		
Producing sectors	1	$X_{11} \ldots X_{1j} \ldots X_{1n}$	C_1	I_1	G_1	E_1	X_1
	.	. . .	.	.	.	.	.
	.	. . .	.	.	.	.	.
	.	. . .	.	.	.	.	.
	i	$X_{i1} \ldots X_{ij} \ldots X_{in}$	C_i	I_i	G_i	E_i	X_i
	.	. . .	.	.	.	.	.
	.	. . .	.	.	.	.	.
	.	. . .	.	.	.	.	.
	n	$X_{n1} \ldots X_{nj} \ldots X_{nn}$	C_n	I_n	G_n	E_n	X_n
Labour		$L_1 \ldots L_j \ldots L_n$	L_C	L_I	L_G	L_E	L
Other value added		$V_1 \ldots V_j \ldots V_n$	V_C	V_I	V_G	V_E	V
Imports		$M_1 \ldots M_j \ldots M_n$	M_C	M_I	M_G	–	M
Total gross outlay		$X_1 \ldots X_j \ldots X_n$	C	I	G	E	X

In addition, summation across the totals row and down the totals column yields the economy's total gross output:

$$X = \sum_{j}^{n} X_j + C + I + G + E \quad \text{(row)} \qquad \text{III.3}$$

and

$$X = \sum_{j}^{n} X_i + L + V + M \quad \text{(column)} \qquad \text{III.4}$$

However, since

$$\sum_{i}^{n} X_j = \sum_{i}^{n} X_i$$

all the intermediate flows can be cancelled out. In this way we obtain

$$L + V + M = C + I + G + E. \qquad \text{III.5}$$

Value added + Imports = Final demand

Transferring imports to the right hand side of the equation gives the traditional social accounting identity of gross regional income and gross regional product (expenditures), i.e.

$$L + V = C + I + G + (E - M). \qquad \text{III.6}$$

Gross regional income = Gross regional product

That is, the sum total of income payments by the productive system to the final sectors is equal to the total value of finished goods and services purchased by the final sectors for consumption, investment, government and net exports.

2. The Input-Output Analytic Framework

Conversion of the transactions table from a descriptive and accounting devise to an analytic tool is achieved in the following manner.

In describing the rows in Figure 1 the following expression was used:

$$X_i = \sum_j^n X_{ij} + (C_i + I_i + G_i + E_i) \qquad \text{III.7}$$

Focussing on a particular row, say row one, collapsing final demand into a single term, Y, and expanding the interindustry transactions term permits this expression to be rewritten as:

$$X_1 = X_{11} + X_{12} + X_{13} + Y_1, \text{ where } n = 3. \qquad \text{III.8}$$

Rearranging gives:

$$X_1 - X_{11} - X_{12} - X_{13} = Y_1 \qquad \text{III.9}$$

By assuming that the amount of industry $_1$'s output purchased by each of the purchasing industries is a stable function of the latters output, III.9 can be re-written as:

$$X_1 - a_{11} X_1 - a_{12} X_2 - a_{13} X_3 = Y_1 \qquad \text{III.10}$$

where $a_{11} = \frac{X_{11}}{X_1}$; $a_{12} = \frac{X_{12}}{X_2}$; $a_{13} = \frac{X_{13}}{X_3}$

The "a"s are called the direct input coefficients, and in an n sector model they represent the direct requirements of the output of any sector i per unit of output of any other purchasing sector j. The crucial assumption for Equation III.10 to hold is that the money value of goods and services delivered by an industry i to other producing sectors is a linear and homogenous function of the output level of the purchasing sectors j. More precisely, the specific assumptions are as follows: no joint products, since each commodity is supplied by a single industry via one method of production; the linear input functions assumption means constant returns to scale and no substitution between inputs; additivity, i.e. the total effect of production is the sum of the separate effects, which rules out external economies and diseconomies; the system is in equilibrium at given prices; and in static versions of the input-output model, no capacity constraints so that the supply of each good is perfectly elastic, thereby ignoring problems of capital.

If the linear input coefficients remain constant over time, they provide a basis for linking final demand to gross output. Input-output analysis describes the interaction of three elements of an economic system: final demands, the input requirements of each industry, and their gross outputs. The main analytical purpose of input-output is to determine the effects of specified changes in final demand upon gross output, given the input coefficients matrix. Such effects include not merely the direct impact, i.e. the first round of input requirements, but also the indirect effects of additional deliveries of these inputs on all industries in the economy. To capture all the first, second, third and higher order effects in a single set of equations the input-output system is expressed in matrix form, where the matrix form equation represents a set of equations, with one equation like (III.10) above for each sector:

$$X - AX = Y \qquad \text{III.11}$$

where X and Y are column vectors of gross output and final demand respectively, and A is an n x n matrix of the direct input coefficients, a_{ij}.

Factoring X from III.11 gives

$$(I - A)X = Y, \qquad \text{III.12}$$

where I is an identity matrix.

Under the condition that (I-A) has an inverse, it is possible to use the inverse matrix to express gross output as a function of final demand:

$$X = (I - A)^{-1} Y \qquad \text{III.13}$$

$(I-A)^{-1}$ is the Leontief inverse matrix.

Now let this inverse matrix $(I-A)^{-1} = B$ and the elements of $B = b_{ij}$. These coefficients (b_{ij} s) represent the direct and indirect requirements of sector i per unit of final demand for the output of sector j. Thus

$$X_i = b_{i1} Y_1 + b_{i2} Y_2 + b_{i3} Y_3 \qquad \text{III.14}$$

We can multiply the inverse matrix B by any size and composition of final demand in order to obtain the level of gross output for each industry. This provides a powerful tool of analysis since it makes it possible to measure the total impact on the economy of exogenous disturbances (i.e. changes in final demand).

The (new) X_is thus obtained can then be substituted back into equation III.10 for each industry, i, which produces the new interindustry transactions associated with the new (forecast) level and composition of final demand. Rearranging back into the form of equation III.8 for each industry gives the new input-output table descriptive of the economy at that point when it has fully adjusted to the new (forecast) level and composition of final demand.

As this brief description has indicated, input-output is the most comprehensive analytic technique generally available for the description and analysis of regional economies. It includes the accounting relationships found in income accounts and in addition includes the interindustry transactions in the economy which the income accounts do not. The input-output technique is capable of spelling out the ramifications throughout the economy of a change in the composition of demand within a purchasing sector which income determination models generally handle poorly, if at all.

In addition the input-output model is flexible and will permit a variety of somewhat different interpretations of the functional relationships between sectors in the economy. For example, various degrees of model closure may be adopted depending on how many components of final demand are shifted from the exogenous portion of the input-output table into the endogenous matrix. The most common change is to include households in the matrix, thereby making consumption a function of autonomous changes in income. Another possibility is to treat investment as induced, and to include investment among the endogneous sectors. At the other other extreme, it is even permissible to transfer all items of final demand except exports into the matrix. In this case the input-output model becomes merely a highly disaggregated export base model.

In short, input-output provides a comprehensive, powerful and flexible tool for economic analysis. These are usually the reasons why it is chosen over alternative approaches.

B. THE THEORETICAL MODEL FOR YUKON

1. Design of the Transactions Table

The economy of the Yukon is typical of provincial or regional economies elsewhere in Canada in some respects but is unique in others. It is typical in that it has a small group of market oriented "export" industries. These are the mining and tourism industries primarily and, to a lesser extent, fur exports from "traditional" activities. Sporadically, the oil and gas industry shows some indication of developing into an export activity but to date it has not become significant. While export sectors, typify the structure of all regional economies in Canada, the specific industries making up the export sector will reflect the region's comparitive advantage or specialization.

Regional development theory argues that a common group of trade and service industries will develop around and be supported, directly and indirectly, by export industries whenever and wherever they develop. This is commonly observed in practice and the Yukon is like other regional economies in this respect. That is, trade and service activities, of a common variety, are present which, on a per-capita basis, are similar to those present in other regional economies.

The Yukon differs from other regions in the degree to which government is present in the economy and to the extent to which a portion of its population is engaged in traditional activities. Indeed, the government sector is in one respect like an export industry in that it brings in funds from outside the Territorial economy. Functionally as well, the expenditure of government funds within the Yukon, in excess of those raised within the Territory, provide a major source of support for the local trade and service industries both through direct spending and indirectly through salaries paid and then locally spent.

Selection of sectors for the Yukon transaction table was therefore suggested by the economic importance of the sectors or by the socio-economic concern for certain activities or the people engaged in them. Thus, to the extent permitted by the data, the export sectors were selected for separate identification.

Hard-rock and placer mining, oil and gas, tourism, government and fur production were identified as candidates for separate and specific inclusion.

Conceptually the hard-rock and placer mining sectors, the oil and gas industry and government presented no problems although data for the placer mining industry proved to be unavailable and had to be obtained completely by survey.

Tourism and fur production both presented conceptual problems. In both these cases a common set of inputs is utilized to produce additional products or services which are used for purposes other than exports. In the trapping industry the rifles, skidoos, etc. that are used to produce furs are also used for subsistence hunting. Further, even some trapping activity results not only in marketable exports but also food for the trapper and his family. Thus Hunting, Fishing, Trapping and Subsistence were combined into a single sector. The inputs utilized by this sector produced both exports and income-in-kind (which was entered into the consumption column of final demand). The "tourist industry" is in fact not a single industry but consists of portions of the trade and service sectors. As with fur production, a common set of inputs is used to produce outputs for both residents and non-residents. In this case, that portion of the output of the trade and service sectors sold to residents was entered into the consumption column of final demand while that sold to non-residents was assigned to the export column of final demand.

An examination of secondary sources in the first stage of the study indicated that it would probably be possible to include seven additional sectors. These were Forestry, Transportation, Construciton, Utilities, Trade, Services, and Manufacturing. The Yukon River Basin Study directors requested the inclusion of a separate Placer Mining industry and for separation of Trade into Wholesale and Retail categories and the separate identification of Finance, Insurance and Real Estate from Services. Since data was not readibly available in complete form to support these additional classifications, data collected on a first hand basis and approximation techniques were in due course utilized to separate them out. Thus 13 industrial classifications were selected, reflecting the considerations outlined above. These were: (1) Hard Rock Mining; (2) Placer Mining; (3) Oil and Gas; (4) Forestry; (5) Hunting, Trapping Fishing and Subsistence; (6) Transportation; (7) Construction; (8) Utilities; (9) Wholesale Trade; (10) Retail Trade; (11) Services (12) Finance, Insurance and Real Estate; (13) Manufacturing.

Final demand categories chosen were selected to accord with income accounting convention and to facilitate closure of the model to the degree desired by moving consumption and/or investment into the endogenous sector of the table.

2. Development of A Physical Input Requirements Component

An ability to determine physical input requirements for any level and composition of final demand has been provided for. This is achieved in the following manner. Maintaining the conventional assumptions of linearity, etc., physical input utilization, by the industrial classifications used in the Yukon table, for 1978 or 1981 (whichever the analyst choses to use as the base year) is divided by gross output for that year to obtain a coefficient for "physical input per dollars gross output", i.e.

$$\frac{PI \alpha_i}{X_i} = p \alpha i \qquad \text{III.15}$$

Where, $PI \alpha_i$ is the physical input requirement for input α by industry i, and α may be stated in terms of cubic feet of water, btus, kwh or whatever physical measure is desired;

X_i is the gross output of industry i for the base year; and,

$p \alpha i$ is the "physical input per dollars gross output" coefficient for industry i.

$p \alpha i$ coefficients are then arranged in an n x n (13 x 13) square matrix, P, with the coefficients arranged along the principal diagonal and zeros in all other cells. This matrix is then multiplied by a 13 x 1 column vector, $\overline{X}$, which contains the new gross outputs associated with any new (forcast) level and composition of final demand. The product, also a 13 x 1 column vector, contains the new total physical input requirements to support this new level and composition of gross outputs, i.e.

$$P \overline{X} = \overline{P} \qquad \text{III.16}$$

where P is the physical input coefficient matrix; $\overline{X}$ is the column vector of gross outputs associated with any new (forecast) level of final demand; and $\overline{P}$ is the column vector of physical input requirements, stated in kwh, btus or whatever, associated with the new gross outputs.

C. METHODOLOGY FOR AN INPUT-OUTPUT TABLE FOR YUKON

1. Assumptions and Procedures

i. General Theoretical Considerations

This section identifies the general theoretical assumptions and procedures used in preparing the 1978 and 1981 Yukon input-output tables and some specific theoretical considerations such as the endogenization of the household sector and the treatment of imports as a row versus a column. Most of the more specific or detailed assumptions employed in construction of the tables were made because of data considerations. A discussion of these assumptions is therefore incorporated into the next section (III.C.2) entitled Data Utilization And Detailed Accounting Framework.

Of necessity, the usual assumptions regarding the conventional input-output model are made. These were mentioned in section III.A.2 and are repeated here for convenience. They are: linear production functions, i.e. constant returns to scale; no substitution between inputs; no external economies or diseconomies; each commodity or group of commodities is supplied by a single industry via one method of production; the system is in equilibrium at given prices; and, there are no capacity constraints. These assumptions are not discretionary. They are the assumptions implicit in the use of the technique. Obviously, these assumptions are never completely met in actual practice. Arguments about the value of the input-output technique are often about the extent to which these assumptions are satisfied and the importance of failing to satisfy any or some of them. It is useful to bear in mind through all of this, however, that all economic models and all techniques are characterized by restrictive assumptions, often the same ones which characterize the input-output technique. [4]

Beyond these general assumptions, the sectors were selected to reflect their economic or socio-economic importance. The table was designed to include as many industries as the available (and potentially available) data suggested were possible. The final demand columns and final payments rows were selected to accord with accounting convention, data availibility, and flexibility for incorporating exogenous categories into the endogenous (interindustry) matrix.

[4] A general discussion of these assumptions and some tests of their validity are found in Hollis Chenery and Paul Clark, Interindustry Economics. New York, John Wiley & Sons, 1965. The evaluations presented are subjective. The reader is able to find comfort in them regardless of his view of input-output.

Three additional conventions deserve mention. The first, a nearly universal practice, is the use of prices charged by the producer rather than prices paid by the purchaser (the difference includes transportation and other distribution costs). Thus using producers prices minimizes the chance of double counting transportation and other distribution costs. This convention was followed in preparing the Yukon and Yukon River Basin Tables. Data was collected on this basis by constructing the questionnaires in a manner that explicitly identified net returns (and thus prices) to the producer.

The second convention involves defining the output of the wholesale and retail trade and many of the services industries as their gross margins, i.e. operating costs plus profits. In utilizing this approach sales of finished goods by the processing sectors are not traced through wholesale and retail outlets even in cases where they are not sold directly to final consumers. The argument is that this procedure allows the output of individual sectors to retain their identity so that final demand purchases can be directly related to the producing sector. On the other hand use of gross margins rather than actual transactions obscures many actual transactions taking place in the interindustry sector of the economy. This practice is commonly, though not universally, followed in North America. It is less commonly followed in Europe. This procedure was not followed in the preparation of the Yukon and Yukon River Basin Tables. Actual transactions were used rather than gross margins thus highlighting interindustry relationships. More interindustry detail was thus provided for with little if any loss since most of the products sold into final demand in the Yukon were produced elsewhere.

Finally, the Yukon and Yukon River Basin tables were constructed on a "gross domestic product" basis following the convention employed in the development of the input-output tables for the Canadian economy. Under this approach the boundaries of production are confined to the Yukon irrespctive of whether the factors are Yukon or non-resident. This contrasts with the "gross territorial product" approach in which the boundaries of production are drawn to include all of the output of Yukon factors of production irrespective of where the production originates.

ii. Methodological Relationship Between 1978 and 1981 Tables

The latest year for which a large body of fairly comprehensive, high quality, data was available was 1978. In particular, it was the last year for which the worksheets used in constructing the Yukon income accounts were available. These worksheets provided the majority of the data to fill in the cells of the final demand columns and final payment rows although, as explained in the next section (III.C.2), some of the distributions were obtained from supplementary data. Information for the interindustry transactions were obtained from interviews held with, and questionnaires returned by, Yukon business firms. The first hand information obtained in this manner was for 1981. This information included detailed data on purchases as well as sales and, of course, total purchases and total sales. With this, purchases from (sales to) all suppliers (buyers) as a fraction of total purchases (sales) were obtained. In effect this process yielded input coefficients of the a_{ij} variety described above (equation III.10).

These distributions or coefficients were then used along with the absolute values of the 1978 final demand columns and final payments rows to infer or derive the remainder of absolute dollar magnitudes for the 1978 table.

The direct coefficient matrix, A, and the Leontiff inverse matrix, $(I-A)^{-1}$, were then produced from the 1978 table (Table 4) in the manner described in section III.A.2. Once the $(I-A)^{-1}$ had been obtained, the 1981 table was produced by multiplying the Leontiff inverse matrix by a vector of final demands for 1981 to obtain the gross outputs required to support the 1981 final demands, i.e.

$$X=(I-A)^{-1} Y \qquad \text{III.16}$$

The 1981 final demands were obtained directly from survey information (questionnaires) in the case of the hard rock mining industry and from DIAND estimates in the case of the placer mining industry. The remainder of the final demands were obtained from output of the Yukon Economic Model provided by the Yukon government's Department of Economic Development. These estimates should be replaced as updated Yukon Economic Account figures become available. Working backward in the fashion of equations III.10 and III.8 produced the 1981 Yukon table in its absolute dollar format which appears as Table 8. The use of the input-output technique requires the assumption that the relationship between inputs and outputs remained constant between these dates.

iii. Additional Methodological Considerations

Two other methodological considerations require explanation. These are the treatment of imports as a row versus a column and the endogenization of the household sector.

Imports may be arrayed in either a row or a column format. Arrayed as a column, imports would be identified as to the industry of origin. This would inform the user regarding the types of imports brought into the economy but would not indicate what use they were put to. Arrayed as a row, the entries indicate the use to which the imports are put but not what they are (other than the division between imports for intermediate use and final demand). For description and accounting purposes both arrays are interesting and useful assuming the data is available in both forms. For analytic purposes, the row array is necessary. Imports for final use can be directly assigned to final demand (in the intersection of the import row and the appropriate final demand column). Imports for intermediate use are then entered directly as the inputs of the purchasing industries. The row array is thus necessary to derive the complete production functions (the columns) for the industries used in the interindustry matrix. It is clear that a column array (only) would not permit the completion of this essential step.

Sometimes, if data permits, imports are divided into competitve and non-competitive categories (where competitive imports refer to imports of a type being produced in the region). These may form a separate row and thus indicate perhaps, the possibility for economic development of an import-substitution variety. Or, non-competitive imports may be assigned to the purchasing industry in an import row while competitive imports are added to the output of the corresponding domestic industries and to their sales to the actual purchasers of imported goods. Either practice maintains the integrity of the total outlay column. The latter, however, alters some of the input coefficients to show what is used as an input rather than where it is obtained.

For the Yukon table the data was available in complete form only by final demand and intermediate categories. Thus it was only possible to develop a single import row.

Endogenization of the household sector is just one form of shifting final demand categories from the exogenous portion of the input-output table to the endogenous matrix. The logic of this particular shift is that it makes consumption a function of autonomous changes in income. It is accomplished by shifting the consumption column and an entry of equal magnitude from the labour income row into the interindustry matrix. (The numbers remaining in the labour income row represent savings and direct taxes. This procedure maintains the equality of the truncated final payments rows and final demand columns). A new direct coefficients matrix is formed, i.e.,

$$(A + h) \qquad \text{III.17}$$

where h refers to the household sector. From this matrix a new direct-plus-indirect coefficients matrix is produced, i.e.,

$$[I - (A + h)]^{-1} \qquad \text{III.18}$$

Having done this, it is possible to derive income multipliers which take into account the repercussionary effects of secondary rounds of consumer spending in addition to the direct and indirect interindustry effects. It is also possible to develop forcasts with this (alternative) model by multiplying forecast final demand by this new inverse, i.e.

$$X = [I - (A + h)]^{-1} Y, \qquad \text{III.19}$$

obtaining new gross outputs and then reconstructing a new input-output table descriptive of the economy at the time when these new final demands have been realized. It is necessary to remember, of course, that consumption spending is endogenous in this model whereas it has been viewed as exogenous in the previous formulation.

2. Data Utilization And Detailed Accounting Framework

i. Methodological Considerations Underlying Construction of The Model

In this section the more specific assumptions and the procedures employed to implement them are discussed. These specific assumptions and procedures were made within the framework of the overall input-output methodology described in section III.A and the application of these general methodological considerations in the Yukon context described in III.B and III.C.1. The more specific considerations explained in this section were developed primarily in response to the form in which the data were obtained. Two major sources of data were utilized. These were the existing published and unpublished materials, described above, the most important of which were the worksheets used in preparing the Yukon income accounts obtained from the Department of Indian Affairs and Northern Development. The second were the questionnaires obtained from Yukon firms. These sources yielded different information and are therefore best treated separately.

a. The Worksheets and Other Available Information

As indicated previously this information was used to construct the final demand columns and the final payments rows for the 1978 Yukon table (Table 4). DIAND provided 183 worksheets and from these as well as the questionnaires 71 additional worksheets were derived. Copies of these were previously provided the Yukon Department of Economic Development and Intergovernmental Relations. The 183 worksheets obtained from DIAND were identified with a "D" followed by a number. The 71 worksheets derived from them were identified with an "S" followed by a number. In the detailed account which follows, an explanation is provided of how the final payments rows and final demand columns were constructed from this data. Where additional data were used, as is occasionally the case, the source is explicitly identified. The discussion is necessarily tedious and complex. The logic can be followed by reading through without reference to the worksheets but to actually follow through, however, will require consistent and frequent referencing of the "S" and "D" worksheets, cross referencing of these worksheets and occasional other data sources. Numerous useful comments are written in at appropriate places on the "S" worksheets which should not be overlooked. Because of the detailed construction of both the "D" and "S" worksheets, considerable information about specific firms and industries financial activities is contained in them. The information is considered confidential and the worksheets are therefore not included in this public report.

a.1. Final Payments Rows

There are six final payment rows in the Yukon table (rows 15 through 20). These are followed by a Total Final Payments row (21) which sums the final payments entries of each column (for each sector listed across the top of the table). The final row of the table (22) sums the entries in the entire column. These totals represent total outlays by the industries identified across the top of the table. Data sources for, and derivation of, each of rows 15 through 20 are explained below. Rows 21 and 22 are self-explanatory.

a.1.1. Indirect Taxes Less Subsidies

Information for the construction of the Indirect Taxes Less Subsidies row was derived from the documents "Consolidated Income and Outlay Account: Gross Domestic Product" (D83) and "GDP at Factor Cost by Industry" (D111). The entries on D111 are summaries from worksheets D143 through D155. However, indirect taxes less subsidies were not available on an industry by industry basis from the worksheets. As a consequence the distribution by industry was obtained by taking the ratio of indirect taxes less subsidies to value added less indirect taxes less subsidies for each industry from the Statistics Canada national input-output table for 1971. This ratio was then applied to value-added less indirect taxes less subsidies to obtain the distribution for the corresponding industry in Yukon. Indirect taxes less subsidies calculated in this way were greater than what appeared on the worksheets. They were then scaled down proportionately to bring them in line with total indirect taxes less subsidies as it appears in the "Consolidated Income and Outlay Account: Gross Domestic Product" (D83). The specific calculations are shown on a step by step basis on worksheets S4 through S10. The entries which appear in row 15 of the 1978 Yukon input-output table are shown on worksheets S8 through S10. The row sum which appears in the intersection of row 15, column 14 is $12,139,000. It differs from the total from the DIAND worksheets ($12,527,000) by 3 percent. This adjustment was arbitrarily made to ensure that total final demand equals total final payments as explained in the note on S10.

a.1.2. Other Operating Surplus

The Other Operating Surplus row was calculated from "GDP at Factor Cost by Industry", (D143 - D155). Other operating surplus is defined as the sum of corporate profits before taxes, other investment income and the inventory valuation adjustment. In general positive figures indicate a profitable industry while negative figures reflect an unprofitable industry. These calculations are summed onto worksheet S11 and shown in detail on worksheets S12 and S13. The entries that appear on S11 are those which appear in row 16 of the 1978 Yukon input-output table except that the entry for retail trade was divided between wholesale and retail trade. The separation of trade into wholesale and retail trade is explained later (in the section on the Labour Income row). It will be noted that the large losses recorded for the Forestry and the Transportation industries derive directly from D145 and D154 respectively.

a.1.3. Depreciation

Depreciation for industries (the capital consumption allowance) was derived from "GDP at Factor Cost by Industry", (D143 - D155). For some industries, the most important of which was Utilities, no depreciation figures were included on the DIAND worksheets. In a like fashion information on depreciation for the Placer Mining industry was insufficient. Like Utilities, therefore, it was also excluded for Placer Mining. Government's capital consumption allowance was derived from the document "Consolidated Income and Outlay Account: Consolidated Government Outlay" (D83). Following the procedures used in developing the territorial economic accounts, the household portion of the capital consumption allowance of the Finance, Insurance and Real Estate industry group was assumed to be the imputed capital consumption allowance on fixed assets held by persons and unincorporated business. As such it was allocated to depreciation payments by households. The individual entries are summed onto worksheet S14. These are the entries which appear in row 17 of the 1978 input-output table with the following exception: The commercial activities of the government, which give rise to "other current revenues" (D29), were assumed to be of a "services" nature. As such, 20 percent of government depreciation was allocated to the services sector. This altered the distribution between the final payments and the final demand sectors of the table from what appears on S14. The total, $81,238,000, which apears in row 17, column 22 is, of course, unchanged. The separation of the "services" component of government activity is explained in the section on government final demand.

a.1.4. Net Income of Unincorporated Business

The net income of unincorporated busines was obtained from the documents, "GDP at Factor Cost by Industry", (D143 - D155) and from "Consolidated Income and Outlay Account: Gross Domestic Product" (D83) for the business section of this row. These entries appear on worksheet S15. The information on S15 was supplemented by adding $623,000 (row 18, column 12) for the placer mining industry, a figure that was obtained from the questionnaires returned from that industry. (The placer mining industry is discussed in section III.E.) The entry in the final demand portion of row 18 (column 19), that for imputed rents on owner occupied dwellings, was obtained from "Household Outlay: Personal Expenditure on Goods and Services" (D81).

a.1.5. Labour Income

Labour income, which is the sum of wages and salaries, supplementary labour income and, in the case of government, military pay and allowances, was derived from "GDP at Factor Cost by Industry" (D143 - D155). These figures were then adjusted for income in kind, which represents free and subsidized accommodation, board and transportation to the employment site, and is recorded on the worksheets as a component of supplementary labour income. Correctly, income in kind should appear as a cost of production in the inter-industry portion of the input-output table and not in the final payment or the final demand portions of the table. Accordingly income in kind was subtracted from supplementary labour income of government and the mining industry and later added back as purchases from the producing sectors. Total income in kind from the document "Household Outlay: Personal Expenditure on Goods and Services" (D80-D82) was distributed between government and mining in the same proportion that supplementary labour income is distributed,that is one-third to government and two-thirds to mining of a total of $5.452 million. These calculations are recorded on worksheets S17 through S19, and summarized on S16. These figures were supplemented by the addition of $624,000 of labour income for the placer mining industry from the questionnaires returned by firms in that industry. The entries on S16 were subsequently further modified in the following manner:

i. That portion of government activity which is of a services nature was transferred to the service industry (mentioned above and elaborated on in the section on government final demand).

ii. Wages and salaries for the construction sector, as recorded on D148, were double those of the previous year and well above the long term trend. In order to make the transactions of this sector more representative of long term relationships, labour payments were arbitrarily scaled down to reflect the average of the increases between 1975-76 and 1976-77 to arrive at the 1978 figure. (Capital consumption and net income of unincorporated business did not show an abnormal increase and were entered in the appropriate rows as recorded. Profits were also very high but were not adjusted on the assumption that the higher volume of output associated with even the downward adjusted labour figure could reflect better use of machinery and equipment, lower overhead, etc., and thus lower unit costs consistent with higher profits).

iii. The information on the wholesale trade sector in the DIAND worksheets reflected an almost total absence of this sector in the Yukon. Information in the Dun and Bradstreet Reference Book, the telephone directory for the Yukon and from returned questionnaires indicated that there is a substantial wholesale trade sector in the Territory. Similarly, the retail trade sector appeared underrepresented in the worksheets compared with these other sources of information. The labour income figures for these sectors from the DIAND worksheets ($6,884,000 for retail trade, zero for wholesale trade) became completely incompatible with the other data obtained. Consequently, in the latter stages of attempting to reconcile the questionnaire data with that from the worksheets it was decided to take the bold step of increasing the labour income in these sectors by enough to make them compatible with the other data. Labour payments to the combined wholesale and retail sectors were raised to a conservative 17 percent of estimated total sales of these two sectors.[5] This increase was made under the constraint that the total labour income payments, after these adjustments, would never-the-less sum to the overall total of those recorded on the DIAND worksheets (plus the additional figure for the placer mining sector). The distribution between the wholesale and retail sectors was derived from the ratio of labour payments per dollars sales from the questionnaires. The ratios, 15 cents per dollars sales for the wholesale sector, 18 cents per dollar for the retail in the Yukon is comparable with that from other input-output tables - the ratio for Utah being 12 cents per dollar and 19 cents per dollar respectively.

Thus, the entries from the DIAND worksheets sum to $179,597,000. This figure, plus the $624,000 for placer mining, sum to $180,221,000. The total in Table 4, row 19, column 22, is $180,222,000 with the difference of $1000 due to rounding.

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[5] A number of input-output tables for sub-national areas were surveyed for guidance in this regard. The ratio of labour outlays to total sales ranged from a low of 15 percent for a 1965 table for Utah to a high of 34 percent for a 1980 table for Saskatchewan. Iver E. Bradley, Utah Input-Output Study. Salt Lake City, Bureau of Economic and Business Research, University of Utah, 1970. The unpublished Saskatchewan table was prepared by Surendra Kulshreshtha, Department of Agricultural Economics, University of Saskatchewan, Saskatoon, 1983.

a.1.6. Imports

Some imports are made directly by final buyers, in which case they are regarded as final demands and are recorded in the final demand columns (15 - 19) of the import row. Others are made by the business sector for direct resale or for use in some production process which gives rise to a salable product. This latter category of imports are recorded in the industry purchasing columns of the imports row (columns 1 - 13).

The division into these two basic categories was arrived at in the following manner. The total dollar value of imports by the business sector was calculated from "Non-residential Sector Income Account: Sale of Goods and Services" (D1 - D6). These transactions are summarized on S42 and S43. A total of $69,475,000 of goods of the second type identified above were imported. This figure is recorded on worksheet S1. It corresponds conceptually with the entry in row 20, column 14 in the 1978 Yukon input-output table but differs from it by $2,672,000 for reasons which will be explained shortly. The distribution of these imports purchased by the business sector was derived from the questionnaires. The other entries in the imports row summarized on S1 come from the final demand categories of "Value of Physical Change in Inventories" (S2 - S3); "Government" (S23 - S33); "Gross Fixed Capital Formation" (S34 - S36); "Consumption" (S20 - S22).

The total imports of final goods are recorded as $95,291,000 on S1. [6] This figure corresponds conceptually to the total entered in row 20, column 21, but differs from it by the same $2,672,000 mentioned just above. The $2,672,000 represents the transfer from the government to the service sector for imports used in market type government activities. These adjusted sums add to the final import entry in column 20, row 22, of $164,766,000. This figure differs from the import figure on D84 by $13,850,000, the figure for wages and salaries of non-residents. The difference is explained as follows. Wages and salaries of non-residents are a component of Gross Domestic Product. In the DIAND income and product accounts, these wages and salaries are a component of total wages and salaries on the income side and of imports on the product side. In the input-output tables imports appear as a row along with labour income, both being a cost of production. To include wages and salaries of non-residents in both imports and labour income in the input-output tables would be double-counting.

[6] Each of the "S" worksheets are derived from one or more "D" worksheets. Thus S2 and S3 are derived from D7 - D11. S20-S22 derive from D80-D82; S23 - S33 derive from D31, D33, D35, D36, D38, D74-D76, D155, D159, D161; and S34 - S36 derive from D1-D4, D83-D86.

a.2. Final Demand Columns

There are five final demand columns in the Yukon table (columns 15-19). these are followed by an Imports column which serves no functional purpose but does allow the assignment of the GDP column the same number as the Total Final Payments row (21) and the Total Production column the same number as the Total Outlays row (22). The GDP column sums the final demands in that row while the Total Production column sums the entire row and represents total sales by the industries listed down the side of the table. Data sources for, and derivation of, each of columns 15 through 19 are explained below. Columns 20 - 22 are self explanatory.

a.2.1. Value of Physical Change in Inventory

The standard convention in input-output accounting is to regard production for inventories as sales to final demand and to regard the absorption of stocks as if they were primary inputs. This convention was followed in preparing the Yukon tables. The data was derived from worksheets D7 - D11. The calculations are recorded on worksheet S3 and the entries which appear in column 15 of the 1978 Yukon input-output table are recorded on S2. The only significant entry was the production for inventory of $17 million by the hard rock mining sector. Inventories in the service, retail trade, manufacturing and transportation industries were assumed to be materials and supplies and, as such, were assumed to be imports. The net of these changes is the $225,000 recorded in column 15, row 20.

a.2.2. Exports

The basic information for the export column was derived from worksheets D39 - D44 and D80 - D82. The actual calculations of each export are recorded on worksheets S38 - S41 (making use of S21 and S22 in the process). The entries recorded in the 1978 Yukon table are recorded on S37 with the single exception of exports from the placer mining sector which were added in from the questionnaires returned from firms in that industry and data supplied by the Department of Indian Affairs and Northern Development. The single largest export item was mineral exports from the hard rock mining sector which accounted for 76 percent of total exports. Exports from the trade and service industries (sales to tourist and temporary non-residents) account for an additional 22 percent. Total purchases by non-residents while in the Yukon, $7.7 million, was taken from D81. Assignment of expenditures by non-resident by sector is shown on a step by step basis on S38 (using information from S21 and S22). The logic behind the derivation of this distribution is as follows:

> It was assumed that purchases by transient non-residents while employed in Yukon fell into the following industry groups: Services (service industry receipts); Retail Trade (the value of retail trade and vending machine sales); Utilities (purchases of electricity, water and sewer charges - territorial and local, and telephone charges - local and long distance); and, Finance, Insurance and Real Estate (rental payments). Purchases by transient non-residents were allocated to these categories in the same proportions that each of these categories (net of business and tourist expenditures) represents of total expenditure on these categories (including imputed rents). The exception was the treatment of rental payments. Purchases by transient non-residents were allocated to actual rental payments by the proportion that total actual rental payments plus total imputed rents represent of total expenditure on the categories enumerated above. Purchases by tourists from the combined retail trade and service sectors ($33 million) was taken from D80. The distribution between retail trade and services was made on the basis of the relative amounts of final demand sales by these two sectors. Step by step calculations are shown on S39 using

information from S21 and S22.

Non-residents are people who maintain their primary residence outside of Yukon while working for short periods in the Territory. There was no explanation of how these people were idenitified in DIAND worksheets although they could have been identified from tax records presumably. In our questionnaires we attempted to provide a more explicit definition of a non-resident for the benefit of respondents. The questionnaires are reproduced in the Appendix to this report.

a.2.3. Gross Fixed Capital Formation (GFCF)

While the column following exports is that for government final demand (column 17), it is deferred until after GFCF and Consumption because some of the calculations pertinent to this sector are discussed in the calculations for GFCF and Consumption. Total GFCF by business ($55.9 million) and government ($58.6 million) was taken from D84. There are four categories of GFCF expenditure: purchases of construction materials, machinery and equipment by business; construction expenditure by business; purchases of construction materials, machinery and equipment by government; and construction expenditure by government. Information on imports of construction materials, machinery and equipment is found in D2. In assigning these imports to the government and business sectors, it was assumed that construction materials, machinery and equipment purchased by government represent the same proportion of government's total gross fixed capital formation as this component is of business's total gross fixed capital formation. However, it was assumed that, in accordance with apparent (revealed) government policy, derived from discussions with the Yukon and Federal government purchasing agents in Whitehorse, only one-half of construction materials, machinery and equipment purchased by government are imported directly and that the other half is purchased through local wholesale trade establishments. The remainder of gross fixed capital formation by business and by government was assumed to represent construction expenditure. Further, it was assumed that one-third of construction expenditure, whether by government or business, went to contracting firms outside the Yukon. The remaining two-thirds was received by the Yukon construction industry. This estimate was subjectively arrived at based on conversations with the government purchasing agents and from information obtained from the questionnaires. Step by step calculation of GFCF is recorded on S35 and S36 and shown in summary form on S34. The entries on S34 are those which appear in column 18 of the 1978 Yukon table.

The procedure outlined in the above paragraph leads to the rather implausible conclusion that the private sector imported all of its capital goods rather than purchasing at least a portion of them from Yukon wholesalers. This assignment in the DIAND worksheets probably dervies from the fact that the Wholesale sector is almost non-existant in the DIAND worksheets as discussed above under Labour Income. If, as is almost certainly the case, the Wholesale sector imported some of these capital goods and resold them to the business sector another apparent anomoly would possibly be resolved. This is the otherwise inexplicably large entry for transportation services purchased by the Wholesale sector (row 6, column 9 of Table 4). The updating of the Yukon Economic Accounts by statistics Canada now under way may shed some light on these questions.

a.2.4. Consumption

The basic source of information for the consumption demand column was obtained from worksheets D80 and D81. Consumption expenditures by Yukon residents were obtained by adjusting the sales figures for Yukon business firms in the following manner:

i. Service industry and retail trade industry sales to final demand were reduced by 11 percent each to account for purchases from these sectors by Yukon business firms. These adjustments are shown on D80.

ii. Purchases by tourists and by non-residents temporarily in the Yukon were deducted from sales by Yukon business firms and assigned to the export column of final demand. This adjustment was explained previously in discussing the development of the export column.

iii. It was assumed that direct (e.g. catalogue) sales plus travel expenditure by territorial residents while outside the Yukon represent imports by households.

iv. the net imputed value of traditional activities (the value of the subsistence harvest) was allocated to consumption final demand. (Other income in kind was discussed in the development of the Labour Income row).

v. Categories of personal expenditure were assumed to fall into industry groups as follows:

   a. Service industry receipts: Services.
   b. Value of retail trade: Retail Trade.
   c. Purchases of electricity: Utilities.
   d. Water and sewer charges (territorial and local): Utilities.
   e. Telephone charges (local and long distance): Utilities.
   f. Vending machine sales: Retail Trade.
   g. Physician and dentist services: Services.
   h. Accident, sickness and life insurance: Finance, Insurance and Real Estate.
   i. Theft and personal property insurance: Finance, Insurance and Real Estate.
   j. Auto insurance: Finance, Insurance and Real Estate.
   k. Rental payments: Finance, Insurance and Real Estate.
   l. Interest on consumer debt: Finance, Insurance and Real Estate.

vi. Imputed rents on owner-occupied housing were allocated to Net Income of Unincorporated Business following the National Income and Expenditure Accounts.

Step by step calculation of consumption demand is shown on worksheets S21 and S22. The figures developed on these worksheets are summarized on S20. The consumption column of the 1978 Yukon table (column 19) is taken directly from S20.

a.2.5. Government

The basic information for government final demand was taken from D29, D31, D33, D35, D36, D38, D66-D68, D74-D76, D143-D155 and from the questionnaires returned by the Yukon and Federal government purchasing agents. The step by step calculation of government demand is shown on worksheets S23 - S33. To obtain government expenditures in the Yukon required adjusting for imports. This was accomplished by taking the total imports figure and subtracting from this: intermediate imports (described in the discussion of the Imports row); imports by households (described in the discussion of the Consumption column); inventory adjustment (included in the discussion of the VPIC column); and, imports of capital goods (see the discussion of the GFCF column). The result is other government expenditures for imports. Subtracting this from government expenditures leaves government purchases from Yukon firms. Government purchases from each industrial sector in the Yukon economy are summarized on worksheets S30 and S31. Because the distribution of purchases by sector was not available from the DIAND worksheets, total government purchases from Yukon firms was allocated to sectors in accordance with the distributions provided on the questionnaires returned by the Yukon and Federal government purchasing agents.

Governments also generated $13 million dollars in revenue in the Yukon. The sources of these revenues were not identified in the DIAND worksheets or from any other source. Therefore on worksheets S32 and S33 government receipts are distributed through the economy according to the distribution in the 1971 Canada input-output table. The resulting figures are shown on S32 and S33 where they are subtracted from government expenditures to obtain net government expenditures. These net figures are the ones shown on S23. This preparation was unsatisfactory because, as shown on S23, it results in negative numbers in the government final demand column for several industrial categories. It was therefore decided to show only government purchases in the government final demand column and to assign the revenue producing activities to a producing sector. Since these activities were primarily of a service nature (67 percent), they were assigned to the service sector. Thus the entries in the government final demand column, down through row 14, are taken from S30 and S31. The entries in the remainder of the final demand column are taken from S23. From the S23 figures the $13,363,000 in government receipts are subtracted (20 percent from depreciation, 60 percent from labour, 20 percent from imports) and added to the corresponding cells for the service industry (These are the "inputs" and reflect the assumption that government revenues are just equal to the cost of producing the services that government sold).

b. The Questionnaire Survey

b.1. Questionnaire Design

The primary data source for the inter-industry transactions portion of the table was questionnaires distributed to Yukon business firms in the summer of 1982. The questionnaires were supplemented by interviews with the largest 15 firms and, to a limited extent, by data from sources such as annual reports, balance sheets, replies by government and private individuals to specific questions, etc. In addition several interviews were conducted with smaller firms.

Two questionnaires were developed. Although they were generally similar, the "B" questionnaire asked for breakdowns in somewhat more detail than did the "A" questionnaire.[7] It was envisaged that the "B" questionnaire (consisting of 24 questions pertaining to both the sales row and the purchases column of the input-output table) would be used for those firms interviewed. Thus, the interviewer could assist with interpretation

[7] For example, in questionnaire "B" firms were asked what industry their purchases from Yukon business firms were made from. In questionnaire "A" firms were asked only to identify a total for purchases from Yukon business firms.

if necessary. The "A" questionnaire (consisting of 18 questions, also pertaining to both purchases and sales) was designed to be mailed out and was made somewhat less detailed in the hope that it would generate fewer questions and therefore possibly a higher return rate. As it turned out, the "B" questionnaires were generally complete and consistent as would be expected from larger firms and firms contacted on a first hand basis. The returned "A" questionnaires varied in quality. Some were as well filled out as the "B" questionnaires. Some were only partially filled out. In some the answers on the purchases questions conflicted with answers to the sales questions, etc. However, quality variation is not uncommon in questionnaire surveys. In the end, there was no evidence which would lead one to conclude that two questionnaires were better (or worse) than one would have been. Copies of the questionnaires are included in the appendix to this report.

b.2. Sample Design

Questionnaires were sent to firms grouped into industry categories according to their two digit SIC classifications as indicated in Table 2. These groupings corresponded with the 13 industrial classifications selected earlier for the interindustry matrix of the input-output table.

The number of firms in each category was determined by a count of the firms in each SIC classification from listings in the Yellow pages of the April 1982 edition of the Northwest Tel, Northern B.C. and Yukon Telephone Directory. If the SIC classification was not apparent from the firms name in the Yellow pages, it was checked with the Dun and Bradstreet Refernce Book which classifies the firms it lists by SIC code.

In selecting the number of firms to survey the following approach was developed. All of the active mining firms in the hard rock mining sector were to be surveyed. All of the firms in the placer mining sector were to be sent questionnaires through the Yukon Placer Mining Association. Data from the Department of Indian Affairs and Northern Development were to be relied on for primary sources of information for the oil and gas, forestry and hunting sectors. These data were: for oil and gas, worksheets D40, D144, D156; for forestry, D12-D22; D145, D146, D156; and, for hunting, D43, D84.

TABLE 2 SIC - INDUSTRY GROUPINGS

INDUSTRY	SIC CODES
Hard Rock Mining *	10
Placer Mining	10
Oil and Gas	13
Forestry	08
Hunting, etc.	07, 09
Transportation	40,41,42,44,48
Construction	15,16,17
Utilities	49
Wholesale Trade	50,51
Retail Trade	52,53,54,55,56,57,58,59
Services	70,72,73,75,76,79,80,89
F.I.R.E.	60,61,62,65,67
Manufacturing	20,23,24,27,28,30,32,35,36,37,39

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* The SIC codes for mining run from 1011 through 1499. Both Hard Rock and Placer mining are in the two digit SIC classification 10. The Placer mining code is 1043 while the Hard Rock classifications differ at the three and four digit level.

With respect to firms in the finance, insurance and real estate sector and the utilities sector, direct interviews or follow ups to the questionnaires were planned. Six of the ten Yukon utilities were provided questionnaires as were 8 of the 33 firms in the F.I.R.E. sector. For the remaining sectors, i.e. transportation, construction, wholesale trade, retail trade, services and manufacturing, it was decided to send out at least 20 questionnaires or to send questionnaires to at least 25 percent of the firms if 20 firms represented fewer than 25 percent of the total for that industry. The percentages actually sent ran from a low of 22 percent to the services sector (89 questionnaires) to a high of 71 percent (132 questionnaires) to the retail trade sector. The reasons why these numbers exceeded the 20 questionnaire or 25 percent approach was to obtain as great a geographical representation as possible (for many communities there were only trade and service firms present). The firms actually sent questionnaires were those that were listed in both the Yellow pages of the phone directly and the Dun and Bradstreet Reference Book except for the small communities for which it was sometimes necessary to use either in order to get any representation at all.

b.3. Survey Results by Sector

A total of 747 questionnaires were provided Yukon business firms including the placer mining indusry, a number equal to approximately one-half of the business firms in the Territory. A total of 107 questionnaires were returned. The returns from those firms interviewed by either our staff or by the Department of Economic Development in the Yukon government were generally of very high quality. The returns from the placer mining industry were also of very high quality in that all or most of the questions had been answered, supplementary information was written into the questionnaires, the sales information was consistent with the purchase information, etc.

The firms interviewed included all the active mining firms in the hard rock mining industry, seven in the finance, insurance and real estate industry, one utility, the largest transportation firm (which declined to respond), the largest wholesaling firm, and the largest retailing firm. Several additional interview and telephone contacts were made by the staff of the Department of Economic Development. The number and percentage of returns by sector are shown in Table 3. The absolute number of returned questionnaires was small in all cases but, for most of the sectors, the largest firms had been interviewed and there were several high quality returns except in the case of utilities. It is not possible to determine the "validity" of this data as that term is used in conventional statistical analysis. The sample was deliberately biased in order to be certain of getting returns from the largest economic entities in the Territory. In this way, it was thought that the disproportionately large share of total economic activity represented by a small number of large firms would be included. The sample was selective in the following additional ways: it was taken primarily, but not totally, from firms listed in both the Dun and Bradstreet Reference Book and from the phone directory, thus excluding firms not listed in one or the other; and a different percentage of firms was sampled from different communities as well, with generally a greater percent of firms sampled in smaller than in larger communities. What can be said is that most of the largest firms co-operated and produced high quality responses. The major exception was the largest transportation firm which refused to participate. In addition there were questionnaires returned by firms in all sectors surveyed with the quality varying from excellent to poor.

TABLE 3 INDUSTRIAL DISTRIBUTION OF FIRMS AND QUESTIONNAIRES SENT AND RETURNED

		Questionnaires		
Industry **	Firms	Sent	Returned	% Returned
Hard Rock Mining	35	35	13	37.0
Placer Mining	270	300	28	10.0
Oil and Gas	*	*	*	*
Forestry	2	1	1	100.0
Hunting, etc.	*	*	*	*
Transportation	125	44	12	27.3
Construction	148	80	13	16.2
Utilities	10	6	1	16.7
Wholesale Trade	122	33	5	15.2
Retail Trade	187	132	11	8.3
Services	396	89	11	12.3
F.I.R.E.	33	8	7	87.5
Manufacturing	33	19	5	26.3
TOTALS	1361	747	107	15.0

*Total firms based on listings in Yellow Pages of April 1982 edition of Northwest Tel, Northern B.C. and Yukon Telephone Directory.

**It is not known for certian how many placer mining firms were in existence in 1981 although the number would be approximately 270. Two Forestry operations in the Yukon were surveyed by Statistics Canada. Although more exist they go into any out of business with a frequency that makes monitoring difficult. Information on the oil and gas industry and the hunting industry was obtained from secondary sources. The 15 percent overall return is calculated as 107 out of 717, i.e. the total has been adjusted for those questionnaires marked "Return to Sender". (30 questionnaires; all from the Placer Mining sector, were marked "Return to Sender" indicating the company had either moved or gone out of business). There were 35 firms in the hard rock mining industry, 30 of which were exploration companies. All of the active mines were interviewed.

b.4. Integration of Questionnaire Data with Worksheet Data

As noted above, primarily secondary sources were employed to complete the interindustry portion of the 1978 Yukon table for the hunting, trapping, fishing and subsistence industry as well as the forestry and oil and gas industries. The remaining interindustry transactions were derived from the questionnaires.

For the hunting, trapping, fishing and subsistence industry, output consisted of export sales and income in kind which totalled $4,630,000 as taken from the DIAND worksheets. This represents the row total and the amount to which the column must total as well. Information from the DIAND worksheets identified $3,598,000 in final payments. The balance $1,032,000 could only represent purchases from other sectors in the Yukon economy. Relying on purchasing patterns identified in other studies [8] of this industry, these purchases were allocated in total to the retail trade industry, row 5, column 10.

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[8] L. Muller-Wille, "Kostenanalyse der modernen Jagd bei den Inuit der kanadischen Zentralarktic." Beitrag zum Trierer Symposium vom 30. 10 bis 1. 11. 1976. Kanada und das Nordpolargebiet an der Universitat Trier. J. Stabler, et al. Socio-Economic Impact Study. Final Report No. 25, Churchill River Study. Regina, 1975. P.J. Usher, Economic Basis and Resource Use of the Coppermine-Holman Region, N.W.T. Department of Northern Affairs and National Resources. Ottawa, 1965. __________. The Bankslanders: Economy and Ecology of a Frontier Trapping Community. Department of Indian Affairs and Northern Development. Ottawa, 1970. 2 Vols.

With respect to forestry and oil and gas, information on final demand, final payments and total output were available from the DIAND worksheets, but first hand information on interindustry transactions proved impossible to obtain. Since the combined total output of these two sectors amounted to only 0.0005 of Yukon GDP, their industry allocations were derived partially as residuals.

In the case of the forestry industry, DIAND officials had provided an estimate of total sales (thus the total to which both the row and the column must sum) (see worksheets D12 - D22). This figure was $2,065,000. From the worksheets final payments of $1,834,000 had been identified leaving $231,000 in purchases to allocate. Allocation of these purchases to other business firms were derived from questionnaires indicating that Yukon business firms had made sales to the forestry industry. The $13,000 in imports was arbitrarily allocated in the final balancing of the table. The DIAND worksheets had also identified final purchases from the forestry industry of $119,000 leaving $1,946,000 to allocate to interindustry sales. From the questionnaires, the hard rock mining industry was allocated $170,000 and construction another $182,000. The balance $1,594,000 (82 percent of interindustry sales) represents sales by the forestry industry to sawmills in the manufacturing sector. However, is possible that there is a problem with these allocations. It is possible that the distinction between sawmills and forestry was not noted by those answering the questionnaires and all interindustry sales might have been made to the manufacturing sector.

For the oil and gas industry, it was assumed that the $57,000 export sales identified in the DIAND worksheets represented total sales, and thus both row and column totals. The worksheets also indicated a net final payment of $34,000, leaving $23,000 to allocate. As with the forestry industry, $13,000 was arbitrarily assigned to imports while $10,000 was arbitrarily distributed to industries in the interindustry matrix during the final balancing process.

For the other ten sectors, i.e., Hard Rock Mining; Placer Mining; Transportation; Construction; Utilities; Wholesale Trade; Retail Trade; Services; Finance, Insurance and Real Estate; and Manufacturing, the procedure used was to distribute dollar values for sales and purchases into the appropriate sectors for each firm responding to the questionnaire. Sector coefficients were then derived using the ratio of the sum of inputs (or sales) to total outlays (or total output) from the questionnaires. For example the $208.6 million total outlay of the Hard Rock Mining sector became the denominator by which all other entries for inputs were divided to obtain sector coefficients. The absolute magnitude of interindustry transactions was inferred from the ratio of total final demand (or payment) figures from the questionnaires to the sums obtained (primarily) from the DIAND worksheets. Thus, for example, the 1981 final payments for the Hard Rock Mining sector equalled 71 percent of total outlays. Therefore the final payments total for 1978, $107.1 million was used to infer a total outlay of $150.6 million. Using the 1981 coefficents and the $150.6 million total, the absolute magnitude of the 1978 interindustry transactons were obtained. Two complete interindustry transactions tables were then developed, one from the purchases coefficients and one from the sales coefficients. If the data were fully compatible, these two tables would be identical. However, they were not. The last, the most difficult (and probably the least scientific) operation was the reconciliation and balancing of the two tables. Several basic assumptions were used in this process:

i. Purchases for most sectors were more reliable than sales. In many industries, sales are not recorded as to the identity of the buyer whereas purchases are typically recorded by identity of the seller.

ii. Some sector coefficients (both purchases and sales) were of higher quality than others. The reasons for this have been previously mentioned. Firms interviewed typically produced the best responses. Larger firms, for the most part, also produced better responses.

iii. Final demand and final payments totals from questionnaires were of variable quality, i.e. some could be changed within a range, whereas some others were known to be very accurate. Totals from the active mining companies in the hard rock mining sector for example were complete records of all transactions and were indisputably accurate. The totals for the F.I.R.E. industry were internally consistent and were consistent with the information obtained from the DIAND worksheets. For other sectors, the totals were known to be less reliable. The refusal of the largest transportation company to participate obviously meant for example that the information obtained from questionnaires was incomplete and had to be supplemented to a greater extent than those from the industries previously mentioned.

iv. Large discrepancies in a cell required going back over the previous work for the two sectors involved, whereas small discrepancies in a cell might be adjusted using one of the previous assumptions.

Balancing and reconciliation of the table took several man-weeks. As more and more totals were finalized, the number of constraints increased, that is, the absolute values that could be put into the remaining cells was constricted to an ever diminishing range of values. Thus, while several of the final entries were obtained as residuals, they were developed within a context where the overall totals were already largely defined - and obtained through a process in which the best data was used first and was not adjusted or was adjusted only in a minor way. Because of the tedious and repetitive nature of this work, worksheets were not systematically produced during this process. Much of the work was done on the computer and was saved only when satisfactory results were obtained. The final iteration in this process is the interindustry matrix in the 1978 Yukon input-output table (Table 4).

b.5 Other Data Sources

Several of the data sources additional to the DIAND worksheets, those derived from them, and the questionnaires have been mentioned in the descriptions of how a distribution was arrived at, how these basic data sources were supplemented, etc. The titles of those documents previously discussed will be mentioned here but detailed discussion of their use is not repeated. Only those few additional sources of information not previously discussed are elaborated on here.

These additional sources previously mentioned included other input-output tables. Specifically mentioned were the 1971 Canada tables, a 1965 Utah table and a 1980 Saskatchewan table. Manitoba and Colorado tables were also consulted. The Territorial Accounts, the Yukon Economic Accounts (in addition to the worksheets used to develop them) and the Price-Waterhouse surveys of the mining industry, the Dun and Bradstreet Reference Book, the City of Whitehorse Business Directory, and the NorthwesTel telephone directory were also referred to. The I-O tables were consulted primarily with respect to distributions or ratios of one category to another (such as final demand as a percent of total production for example). The other documents were referred to regarding addresses, SIC codes, definitions or accounting conventions or for total values for some aggregate (total government expenditures or GDP for example).

A few other documents also proved to be of some importance. Of these a proprietary study by P.E. Gunther entitled Cyprus Anvil: Impact on the Yukon, prepared for Cyprus Anvil, provided, interestingly enough, a good deal of information useful in constructing the transportation sector of the model. Two other documents proved useful in assisting in the development of the transportation sector. These were, Trimac Consulting Services, Ltd. Costs of a Trucking Operation from Faro to Skagway, Calgary, 1979 and Canadian Transport Commission, Report of the Whitepass and Yukon Railway and Other Transportation Services Into and Out of the Yukon, Hull, Quebec (no date). These documents provided information which could be used as benchmarks for the total size of the industry, its importance as a buyer in the Yukon economy and its importance as a provider of services to different industries in the economy.

Finally, information contained in a letter dated 15 November 1982 from Blake Baxter to Robert Reid, both DIAND employees, was used to arrive at total output figures for the Placer Mining industry. In June 1983, subsequent to the completion of the Yukon and Yukon River Basin tables the Department of Economic Development provided a report prepared by R.L. Debicki of DIAND entitled Placer Mining Industry in Yukon and Atlin Mining Division, British Columbia, Whitehorse, February 29 1983, which provided more comprehensive data on the Placer Mining industry. The use of this data is discussed in Part V.

b.6 Data Methods to Handle Energy Component

At the beginning of the project it was envisaged that data on physical input requirements in kwh by the industrial classification would be made available to be used in constructing the Yukon input-output table. However, such information was not received. Nevertheless, a "Physical Input Requirements Component" was developed as explained in section III.B.2. and its use illustrated with ficticious data in the accompanying manual describing the input-output computer programs. If and when physical input requirements are calculated (for any physical input), this information may be substituted for the ficticious data and physical inputs required to support any level of forecast final demand can be calculated.

3. Presentation of the Tables

The 1978 Yukon input-output table (the transactions table), the direct coefficients table, the direct plus indirect coefficients table with households exogenous (the Leontiff matrix), the direct plus indirect coefficients table with households endogenous and the 1981 Yukon table are presented on the following fold-out pages. Since the derivation of each of these tables has previously been discussed in some detail only a brief discussion is provided here.

Table 4, the transactions table, is the result of constructing the 22 x 22 matrix described on a step by step basis in section III.C.2. The entries in the cells of this table represent the raw data describing sectoral transactions in the Yukon economy in 1978 as derived from the data sources previously identified using the procedures discussed in Section III.C.2.

Table 5, the direct coefficients table, was obtained by dividing the entries in each column of the interindustry portion of the transactions table (plus the consumption column) by the respective column total. The interindustry portion of this table (the first 13 rows and 13 columns) constitute the "interindustry coefficients matrix", A, with elements a_{ij} as explained in the discussion of equation III.10. The entries in the Consumption column are there to illustrate what is taken into the interindustry matrix when the model is closed by making the household sector endogenous as explained in section III.C.1.iii. The entries in the final payments rows are also coefficients. However, they are used only to

TABLE 4

Transactions Table   Yukon 1978

															Total Int. Prod.	WIC	X	G	GPY	C	M	GDP	Total Prod.
		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	14	15	16	17	18	19	20	21	22
Hard Rock Mining	I1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17378	133213	—	—	—	—	150501	150501
Placer Mining	I2	—	—	—	—	—	—	—	—	859	—	—	—	860	1719	—	1247	—	—	—	—	1247	2966
Oil and Gas	I3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	57	—	—	—	—	57	57
Forestry	I4	170	—	—	—	—	—	192	—	—	—	—	—	1584	1946	—	—	119	—	—	—	119	2065
Hunting, Trapping, Fishing and Subsistence	I5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	934	—	—	3696	—	4630	4630
Transportation	I6	14103	160	6	80	—	1403	8516	2711	13047	9170	1775	26	284	55380	—	—	2580	—	—	—	2580	57960
Construction	I7	381	46	1	120	—	11740	10081	4114	13358	15304	434	3020	4	67817	—	—	2302	11398	—	—	13700	81517
Utilities	I8	7177	5	—	5	—	681	619	787	743	1115	1053	929	268	13382	—	724	238	—	7187	—	8149	21531
Wholesale Trade	I9	2586	337	2	3	—	2360	2345	209	2501	7851	1766	1862	89	22007	—	—	24486	24961	—	—	49447	71454
Retail Trade	I10	56	20	1	—	1032	1578	1150	—	81	179	1757	123	525	6505	—	25687	7183	—	37571	—	70441	76946
Services	I11	9203	234	—	—	—	3265	2799	3287	1309	8885	5695	113	89	34269	—	12983	2141	—	21027	—	36153	70422
Finance, Insurance and Real Estate	I12	36	30	—	—	—	3290	3035	3087	4221	6381	7179	3280	609	33736	—	1300	—	—	11819	—	13119	46855
Manufacturing	I13	9403	8	—	—	—	93	28	186	34	1045	99	18	49	10923	—	—	635	—	—	—	635	11558
Total Processing	14	43505	857	10	210	1032	24408	38570	14381	40334	51119	19718	9371	4161	247684	17378	176154	39686	36359	81291	—	350868	598552
Indirect Taxes Less Subsidies	15	848	—	7	76	4	1746	3004	-2	1	211	2332	3077	43	13139	—	—	—	—	—	—	—	13139
Other Operating Surplus	16	35234	—	-193	-9169	—	-23254	7573	—	1982	2226	12085	20960	2137	58609	—	—	—	—	—	—	—	58609
Depreciation	17	13096	—	—	9622	—	35360	4584	—	121	141	4636	180	196	68136	—	—	9061	—	1240	—	13101	81237
Net Income of Unincorporated Business	18	—	623	—	16	3594	—	657	210	90	914	2053	556	46	9761	—	—	—	—	7047	—	7047	16808
Labour Income *	19	(23171) 37053	(390) 624	(138) 220	(685) 1095	— —	(8417) 13460	(13478) 21553	(1550) 2479	(6916) 11050	(8649) 13863	(14849) 23745	(2190) 3515	(832) 1330	(81291) 129996	— —	—	50226	—	—	—	50226	180222
Imports	20	30863	862	13	13	—	6240	5536	4463	17859	8372	3853	388	3645	72147	225	—	6969	78244	7181	—	92619	164766
Total Final Payments	21	107006	2109	47	1855	3598	33552	42947	7150	31120	25827	50704	37484	7397	350868	225	—	67056	78244	17468	—	162993	513861
Total Outlays	22	150501	2966	57	2065	4630	57960	81517	21531	71454	76946	70422	46855	11558	598552	17603	176154	106742	114603	98759	—	513861	1112413

* Numbers in parenthesis are scaled down values used for purposes of making the household sector endogenous

TABLE 5

Direct Coefficients Yukon

		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Total Int. Prod. 14	WIC 15	I 16	G 17	OPCF 18	C 19	M 20	GNP 21	Total Prod. 22
Hard Rock Mining	I1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Placer Mining	I2	—	—	—	—	—	—	—	—	.01202	—	—	—	.07441	—	—	—	—	—	—	—	—	—
Oil and Gas	I3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Forestry	I4	.00113	—	—	—	—	—	.00223	—	—	—	—	—	.13791	—	—	—	—	—	—	—	—	—
Hunting, Trapping, Fishing and Subsistence	I5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.03742	—	—	—
Transportation	I6	.09425	.05194	.10526	.03074	—	.02421	.10447	.12901	.25057	.11929	.02521	.00095	.03457	—	—	—	—	—	—	—	—	—
Construction	I7	.00380	.01551	.01754	.06295	—	.30259	.22309	.19187	.10096	.19993	.00618	.00445	.00035	—	—	—	—	—	—	—	—	—
Utilities	I8	.04766	.00169	—	.00242	—	.01175	.00750	.03035	.01040	.01449	.01495	.01983	.02319	—	—	—	—	—	.07377	—	—	—
Wholesale Trade	I9	.01716	.11762	.07509	.00145	—	.04086	.03077	.00971	.03636	.10203	.02900	.07974	.00770	—	—	—	—	—	—	—	—	—
Retail Trade	I10	.00017	.00970	.01754	—	.22309	.02723	.01417	—	.00113	.00233	.02095	.00283	.04456	—	—	—	—	—	.30043	—	—	—
Services	I11	.06170	.07009	—	—	—	.05033	.03434	.15206	.01950	.10507	.00007	.00241	.00770	—	—	—	—	—	.2291	—	—	—
Finance, Insurance and Real Estate	I12	.00024	.01291	—	—	—	.05039	.04815	.14337	.05007	.10762	.10194	.07008	.03530	—	—	—	—	—	.1950	—	—	—
Manufacturing	I13	.06244	.00270	—	—	—	.00160	.00734	.00064	.00040	.01750	.00004	.00036	.00424	—	—	—	—	—	—	—	—	—
Total Processing	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Indirect Taxes Less subsidies	15	.00750	—	.12201	.03600	.00096	.03012	.03605	-.00000	.00001	.00274	.03311	.00274	.00372	—	—	—	—	—	—	—	—	—
Other Operating Surplus	16	.23307	—	-3.30596	-4.44019	—	-.40121	.09290	—	.02774	.03023	.10501	.41025	.10409	—	—	—	—	—	—	—	—	—
Depreciation	17	.00096	—	—	4.75142	—	.01000	.05023	—	.00100	.00103	.00503	.00034	.01696	—	—	—	—	—	—	—	—	—
Net Income of Unincorporated Business	18	—	.31005	—	.00484	.77626	—	.00006	.00975	.00137	.01100	.04375	.01187	.00390	—	—	—	—	—	—	—	—	—
Labour Income *	19	.20605 (.25307)	.21030 (.13149)	3.05965 (2.42109)	.53027 (.33172)	— —	.33223 (.14532)	.26440 (.10334)	.11516 (.07190)	.15477 (.09679)	.10017 (.11206)	.33710 (.21000)	.07502 (.04691)	.12507 (.07190)	— —	— —	—	—	—	0.0	—	—	—
Imports	20	.13054	.29063	.22007	.00630	—	.30766	.00040	.20720	.24994	.10000	.05471	.00020	.31537	—	—	—	—	—	—	—	—	—
Total Final Payments	21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total Outlays	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Coefficients in parentheses are coefficients corresponding to scaled down labour income values used for the case where the household sector is endogenous

TABLE 6

Direct and Indirect Household Response Yukon

		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
Hard Rock Mining	I1	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Placer Mining	I2	0.00512	1.00184	0.00963	0.00011	0.00062	0.00105	.00075	.00129	0.01301	0.00279	0.00063	0.00068	0.07519
Oil and Gas	I3	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Forestry	I4	0.01806	0.00067	0.00026	1.00026	0.00065	0.00130	0.00377	0.00216	0.00104	0.00290	0.00038	0.00926	0.13002
Hunting, Trapping, Fishing and Subsistence	I5	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00030	0.00000
Transportation	I6	0.12449	0.10320	0.11173	0.05364	0.04620	1.09507	0.10862	0.19160	0.30075	0.20765	0.05152	0.03041	0.09962
Construction	I7	0.06763	0.09092	0.07011	0.10112	0.00434	0.33745	1.38305	0.34030	0.36127	0.37030	0.09740	0.12023	0.00104
Utilities	I8	0.05569	0.00005	0.00375	0.00446	0.00642	0.03069	0.01714	1.05167	0.02190	0.02079	0.02103	0.02471	0.02073
Wholesale Trade	I9	0.03161	0.13172	0.04009	0.00706	0.03122	0.00009	0.05745	0.04542	1.07150	0.14007	0.04171	0.09130	0.03836
Retail Trade	I10	0.00990	0.01690	0.02201	0.00316	0.22701	0.03690	0.02641	0.01675	0.01606	1.01050	0.03036	0.00990	0.04036
Services	I11	0.00947	0.10194	0.01536	0.00836	0.01306	0.00025	0.00050	0.20315	0.06230	0.15190	1.10171	0.01516	0.01305
Finance, Insurance and Real Estate	I12	0.03534	0.04765	0.02005	0.01099	0.04027	0.10452	0.09096	0.31927	0.11003	0.10060	0.13640	1.09300	0.06100
Manufacturing	I13	0.06367	0.00130	0.00061	0.00022	0.00332	0.00269	0.00130	0.01086	0.00179	0.01480	0.00171	0.00084	1.00996

TABLE 7

Direct and Indirect Coefficients, Households Endogenous Yukon

		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	H
Hard Rock Mining	I1	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Placer Mining	I2	0.00550	1.00218	0.00485	0.00073	0.00072	0.00143	0.00128	0.00160	0.01341	0.00325	0.00108	0.00083	0.07540	0.00171
Oil and Gas	I3	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Forestry	I4	0.01044	0.00102	0.00452	1.00000	0.00075	0.00151	0.00377	0.00256	0.00145	0.00136	0.00082	0.00053	0.13911	0.00173
Hunting, Trapping, Fishing and Subsistence	I5	0.01013	0.00975	0.11336	0.01856	1.00373	0.01141	0.01305	0.00910	0.01071	0.01223	0.01219	0.00190	0.00770	0.04000
Transportation	I6	0.15400	0.13022	0.46385	0.10302	0.05425	1.11500	0.20772	0.22171	0.13953	0.20138	0.08112	0.04202	0.08211	0.13433
Construction	I7	0.12066	0.14014	0.68119	0.10521	0.09004	0.38856	1.45345	0.40364	0.42024	0.44347	0.12534	0.14138	[illegible]	0.34406
Utilities	I8	0.08190	0.03161	0.29261	0.04605	0.01336	0.04977	0.05038	1.07730	0.04919	0.05906	0.05299	0.03404	0.04035	0.11718
Wholesale Trade	I9	0.05131	0.14971	0.26856	0.04007	0.03652	0.00000	0.06202	0.04539	1.00241	0.16386	0.06542	0.09903	0.04533	0.08944
Retail Trade	I10	0.11944	0.11687	1.24765	0.18203	0.25647	0.10030	0.16736	0.12672	0.13297	1.15007	0.16107	0.04005	0.13234	0.09000
Services	I11	0.17345	0.17064	0.95513	0.14568	0.05646	0.16305	0.17764	0.30773	0.15100	0.25331	1.30076	0.04011	0.09587	0.30125
Finance, Insurance and Real Estate	I12	0.10192	0.10846	0.76510	0.11981	0.05019	0.17952	0.18400	0.20641	0.18641	0.26300	0.21050	1.11002	0.11129	0.30226
Manufacturing	I13	0.06956	0.00511	0.03177	0.00131	0.00302	0.00402	0.00301	0.01296	0.00369	0.01716	0.00380	0.00130	1.00700	0.00050
Households	H	0.27075	0.24725	3.02951	0.44253	0.05307	0.30497	0.34062	0.27290	0.20626	0.33091	0.32575	0.30634	0.30575	1.22900

Transactions Table * Yukon 1985
(In Thousands of Dollars)

Industry		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Total Int. Prod. 14	WPIC 15	I 16	G 17	GFCF 18	C 19	M 20	FDP 21	Total Prod. 22
Hard Rock Mining	I1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3659	205928	—	—	—	—	209587	209587
Placer Mining	I2	—	—	—	—	—	—	—	—	1860	—	—	—	1193	3052	—	44000	—	—	—	—	44000	47052
Oil and Gas	I3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Forestry	I4	435	—	—	—	—	—	253	—	—	—	—	—	2211	2899	—	—	172	—	—	—	172	3071
Fishing, Hunting, Trapping and Subsistence	I5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1182	—	—	4513	—	5695	5695
Transportation	I6	19079	2506	—	111	—	2087	12943	2587	24990	13670	2389	34	394	79178	—	—	3725	—	—	—	3725	82903
Construction	I7	809	720	—	181	—	16792	28421	5444	19990	19526	584	4014	6	94087	—	—	3323	15941	—	—	19264	113351
Utilities	I8	9981	78	—	7	—	634	880	1061	1090	1415	1827	1235	377	18631	—	901	368	—	8815	—	10084	28715
Wholesale Trade	I9	3579	5238	—	4	—	3387	3361	277	3799	9865	2376	3475	123	30525	—	—	35350	34989	—	—	70339	100864
Retail Trade	I10	77	454	—	—	1369	2257	1886	—	138	228	2364	164	714	9353	—	10961	19370	—	60080	—	88411	97644
Services	I11	17887	3665	—	—	—	4675	3892	4349	2952	10262	7662	150	125	49183	—	18154	3894	—	25789	—	45837	94980
Finance, Insurance and Real Estate	I12	50	595	—	—	—	4691	5458	4895	6390	10521	9659	4360	567	46165	—	1629	—	—	14485	—	16114	62279
Manufacturing	I13	13024	175	—	—	—	133	39	246	50	1326	80	28	68	15115	—	—	917	—	—	—	917	16032
Total Processing	14	87261	13422	—	303	1369	34912	53632	18829	59148	64883	20130	13435	5772	351616	3659	300735	51395	50850	99702	—	512241	863857
Indirect Taxes Less subsidies	15	1164	—	—	186	5	2497	4177	-3	1	268	3138	5153	60	18766	—	—	—	—	—	—	—	18766
Other Operating Surplus	16	48801	—	—	-12750	—	-13282	10530	—	2987	2852	17605	38504	2964	78255	—	—	—	—	—	—	—	78255
Depreciation	17	10140	—	—	13958	—	58577	6374	—	177	179	6238	239	272	95853	—	—	14236	—	3974	—	18210	114063
Net Income of Unincorporated Business	18	—	8757	—	14	4421	—	954	270	144	1180	4198	739	64	22590	—	—	—	—	8643	—	8643	30241
Labour Income	19	51121	9773	—	1523	—	19252	29970	3280	16220	17996	32940	4672	2045	187390	—	—	72512	—	—	—	72512	259958
Imports	20	28098	11580	—	18	—	8625	7754	5906	26189	10630	5584	516	9856	112573	47	—	10061	109428	8807	—	170344	280916
Total Final Payments	21	149177	33030	—	2568	4426	47991	59718	9461	49638	32781	48520	49023	10260	512342	47	—	96809	109428	21424	—	227700	739951
Total Outlays*	22	209590	46452	—	2871	5695	82903	113350	28491	104784	97664	68750	62278	16032	863858	3706	300735	154184	160278	121126	—	739958	1603808

* Column and Row entries may not sum precisely to totals because of rounding

distribute final payments when a new input-output table descriptive of the economy at a time when it has adjusted to any new (forecast) level of final demand is being constructed. This procedure is described in the text following equation III.14. The entries in parenthesis in the labour income row are coefficients corresponding to scaled down labour income values used when the household sector is endogenous.

The direct plus indirect coefficients matrix with households exogenous, Table 6, is the Leontiff matrix. Each entry in this inverse matrix is called an interdependcy coefficient. The coefficient represents the direct and indirect requirements of the sector listed at the side of the matrix per unit of final demand for the sector listed at the top of the table. Thus the entries in row 8 identifies the direct plus indirect requirements placed on the Utilities sector for the production of one dollars final demand for each of the industries listed at the top of the column in which the coefficient is found. Each column in this table shows the output required directly and indirectly by a single sector to support $1.00 of delivery to final demand by each of the processing sectors. The entries in the principal diagonal are all at least "one". The logic of this is that it requires at least one dollars worth of output from each producing sector to deliver one dollars worth of output to final demand. The derivation of Table 6 is explained in the discussion of equations III.11 through III.13.

The direct plus indirect coefficient matrix with households endogenous is shown in Table 7. It is obtained by bringing the household column and row into the transactions matrix, subtracting it from an identity matrix of equal dimensions and inverting as described in equations III.17 and III.18. The coefficients in this table are interpreted in the same way as those in Table 6. However, the "model" contained in Table 7 differs from that in Table 6 in that consumption spending is endogenous in the latter and exogenous in the former.

The 1981 Yukon table is shown in Table 8. It was produced using the direct plus indirect coefficient matrix with households exogenous shown in Table 6. This inverse was multiplied by a column vector of final demands for 1981 to obtain the gross outputs required to support these final demands (See equation III.13). Substituting these new gross output values into III.10 produced the interindustry transactions associated with the 1981 final demands. Rearranging into the form of III.8 produced the 1981 Yukon table shown in Table 8. The process is explained in greater detail in section III.C.1.ii.

4. Comments on the Tables

i. Methods Used to Validate Information

The data obtained for use in constructing the input-output tables fell into five general types. These were, first, published and official (in the sense that they were presented by a government agency as being "factual"). In this category were the Yukon Economic Accounts, the Territorial Accounts, 1971 Canadian input-output tables, and the CTC report on transportation in the Yukon. The second type of information was the official but unpublished data. Included in this category were the worksheets used in constructing the Yukon Economic Accounts and various information provided by DIAND officials such as that for the forestry and placer mining industries. Third was that published by non-government publishers, such as some of the input-output tables, the Trimac study of trucking, the Dun and Bradstreet Reference Book, the Northwest Tel directory, the City of Whitehorse directory, etc. The fourth included proprietary information such as that contained in P.E. Gunther's study of Cyrus Anvil and the Price Waterhouse studies of the mining industry. Fifth were the questionnaires.

The information presented in each of the first four categories could only be interpreted as factual with the possible implicit caveat "to the best of our abilities." The information was also typically extremely complex and sometimes derived from procedures involving confidentiality or those to which only those producing the studies or information had access. Consequently, this information had to be accepted at face value. There is no way to independently validate this data. The procedures used to "validate" the information provided in the questionnaires has previously been discussed (in section III.C.2.). This consisted first of checks for internal consistency and second checks for correspondence with the other data collected. The procedures used when information was lacking or when data sources were in conflict are explained in section III.C.2. on an item by item basis.

ii. Stability Conditions and Consistency Checks

Once the development of the input-output model was completed, checks were made of the tables to determine their stability and consistency. An initial test of the stability of the interindustry direct coefficients matrix is performed by ensuring that no column in the matrix adds up to more than unity and that at least one column adds up to less than unity. In practical terms this means that no industry can pay more for its produced inputs than it receives from the sale of its output. All sectors met this condition in the Yukon and Yukon River Basin direct interindustry coefficient matrices.

A second stability condition, referred to as the Hawkins-Simon condition, applies to the table of direct plus indirect coefficients and states that there be no negative entries in the table of direct plus indirect requirements. In practical terms a negative entry would mean that each time the industry with the negative entry expanded its sales to final demand, its direct plus indirect input requirements would decline. All of the direct plus indirect requirements matrices for the Yukon and Yukon River Basin satisfied this condition.

In addition to these stability conditions there are a number of checks for internal consistency within the transactions table. The first of these is that the sum of the entries in the Total Processing row (row 14) equals the sum of the entries in the Total Internal Production column (14). What this means is that what the industrial sector purchases from itself must equal interindustry sales. Thus the entry in the intersection of row 14, column 14 must be the same whether as a row total or a column total. A second requirement is that total final payments by the processing sectors (the $350,868,000 in row 21, column 14 of the 1978 Yukon table) must equal total final demand sales by the processing sector (column 21, row 14). Third total outlays by the processing sectors (row 22, column 14) must equal total sales by the processing sectors (column 22, row 14). This is the $598,552,000 in these cells in the 1978 Yukon table. Fourth, the sum of total final payments (row 21, column 22) must equal total final demand (column 21, row 22). Fifth, total gross output whether as a column total or a row total must sum to the same number in the intersection of row 22, column 22. The 1978 and 1981 Yukon and Yukon River Basin tables satisfied these checks for internal consistency.

One additional check for the 1978 table is performed by subtracting imports from total final payments and total final demand. The result, $349,095,000, is gross regional income on the left hand side and gross regional product on the right hand side (See equation III.6). Since the gross domestic product approach was used in constructing the input-output table (See section III.C.1.i.), this figure can be compared with the total reported for gross domestic product in the 1978 Yukon Economic Accounts. This figure is $343,806,000. The total from the I-O table is 1.0153 times that reported in the Accounts, a very satisfactory result considering the addition of placer mining and the modifications made to some of the other sectors.

iii. Discussion of Some Cells of Interest

Probably the cells which are of the greatest interest are those which are peculiar in some respect. Two such individual cells have already been mentioned. These were the large negative entries in the Other Operating Surplus row and the Forestry and Transportation columns. As indicated in the previous discussion of these cells negative entries indicate an unhealthy industry (Section III.C.2.i.a.1.2.). These entries were obtained directly from the DIAND worksheets as identified in the section referenced. It is worth noting that the largest transportation company in the Territory has since shut down and that the largest firm in the forestry/lumber business is currently in receivership.

Another entry of possible interest is that in the intersection of the Net Income of Unincorporated Business row and the Hunting, Trapping, Fishing and Subsistence column. The entry, $3.594 million was made to this category, rather than the Labour Income row because it seemed to us that subsistence hunters/trappers are more like proprietors than wage earners because they establish their own times of work and their reward is (probably) in proportion to their own initiatives. This is a debatable point but neither assignment is of any great consequence. The table would have a slightly different appearance, but the overall totals would not change and the use of the tables would not be affected.

Two other entries that attract attention are the entries greater than negative one in the Other Operating Surplus row and the Oil and Gas and

Forestry columns of the direct coefficients matrix (Table 5). These entries occur because of the losses for these sectors which are larger in absolute value than the sum of Total Outlays for these sectors from Table 4. These entries do not present a "problem" in any sense. They simply project the same relationship between losses and other entries in their respective columns as are indicated in the 1978 Yukon table.

D. METHODOLOGY FOR DERIVING YUKON RIVER BASIN TABLE FROM YUKON TABLE

1. Adjustments Made to Yukon Input-Output Table

The 1978 Yukon River Basin table was constructed from the Yukon table by deleting from the Yukon table the activity that occurs in the Yukon but outside of the Yukon River Basin. To this was added activity in that portion of Northwestern British Columbia that is within the Yukon River Basin. In some cases an entire sector was deleted from the Yukon table and in others the entire sector was retained. In the remainder of cases a portion of the sectors were allocated to the Yukon River Basin.

The sectors retained in whole from the 1978 Yukon table were the hard rock mining sector and the hunting, trapping, fishing and subsistence sector and no subsequent modifications were required. The placer mining industry in the Yukon was allocated in total to the Yukon River Basin but was modified by adding to its output, that production which occurs in the British Columbia portion of the Yukon River Basin. In addition the distribution of sales by the placer mining industry was modified in the following way. It was assumed that sales made to the wholesale trade and the manufacturing sectors in the 1978 Yukon table were made to firms in the Yukon River Basin and elsewhere in the Yukon in accordance with the geographical distribution of these industries. Thus, since a portion of these industries are outside the Yukon River Basin the distribution of sales was altered as a consequence of separating the Yukon River Basin from the Yukon. Those sales made to firms in the wholesale trade or manufacturing industries outside the basin were shifted from the interindustry matrix to the export column.

The oil and gas sector was deleted entirely from the Yukon table in creating the Yukon River Basin table and required no subsequent modifications. The forestry sector was allocated primarily to that portion of the Yukon outside the Yukon River Basin. Because of the absence of data for this sector, subjective estimates provided by the Yukon Department of Economic Development and Intergovernmental Relations and personnel in DIAND to the effect that 90 percent of forestry activity was conducted outside the Yukon River Basin were used. Ten percent of forestry activity was retained for the Yukon River Basin. However, since a substantial portion of the output of the forestry industry is sold to sawmills in the manufacturing sector, this necessitated an adjustment to the manufacturing sector as well. Of the $1.594 million allocated to sawmills in the manufacturing sector from the forestry sector in the 1978 Yukon table, all but $25 thousand was removed in creating the Yukon River Basin table. The $25 thousand figure was arrived at as follows. Only 10 percent of the industry's gross output ($207 thousand) was retained for the Yukon River

Basin table. In terms of sales, the hard rock mining industry had accounted for $170 thousand in the Yukon table. On the assumption that the mining companies would buy from the closest supplier, the full $170 thousand was retained for the Yukon River Basin table. Government showed purchases of $119 thousand from forestry in the Yukon table. On the assumption that government purchases were uniformly distributed on a geographic basis, 10 percent of the government demand ($12 thousand) was allocated to Yukon River Basin suppliers. The remainder, $25 thousand, was entered as sales to sawmills in the manufacturing sector in the Yukon River Basin.

Finally, for all other sectors, including the remainder of the manufacturing sector, total gross output figures were scaled down according to the proportion of firms located in the Yukon River Basin. The ratios were arrived at by subtracting the number of firms in each sector outside the Yukon River Basin from a total which included the number of firms in each of these sectors in the Yukon. This identified the number of Yukon River Basin firms in the Yukon. To these totals the number of firms in the Yukon River Basin in British Columbia was added and this total was divided by the number of firms in each sector in the Yukon. This exercise produced fractions by which total gross outputs in the Yukon table could be multiplied to obtain estimates out outputs for these sectors in the Yukon River Basin. These ratios are shown in Table 9.

The actual calculations of the Yukon River Basin table was made by taking the (new) gross outputs arrived at as described above, calculating and substituting back as indicated by equations III.10 through III.8 to produce the absolute dollar 1978 table for the Yukon River Basin.

TABLE 9 RATIOS OF FIRMS IN YUKON RIVER BASIN TO TOTAL YUKON FIRMS FOR SELECTED INDUSTRIES

Industry	Ratio
Transportation	0.94
Construction	0.91
Utilities	0.95
Wholesale Trade	0.93
Retail Trade	0.87
Services	0.93
F.I.R.E.	0.93
Manufacturing *	0.97

Number of Firms based on listings in Yellow Pages of April 1982 edition of Northwest Tel, Northern B.C. and Yukon Telephone Directory.

* This refers to the proportion of firms in the Yukon River Basin after the adjustment for forestry sales to sawmills explained in the text. The reduction of purchased inputs by $1.569 million causes output to be reduced by 2.78 times (the ratio of produced inputs to total input) or $4.362 million.

2. Presentation of the Tables

The Yukon River Basin tables are presented on the following fold-out pages. The 1978 Yukon River Basin table is shown in Table 10. Its development was explained in the preceding section of this report. This is followed by the direct coefficients matrix (Table 11), the direct plus indirect coefficients matrix with households exogenous (Table 12), and the direct plus indirect coefficients matrix with households endogenous (Table 13). These tables (11-13) were produced in a manner identical to that used in producing Tables 5, 6 and 7. The description of the procedures found in section III.C.3. apply across the board. The 1981 Yukon River Basin table is shown in Table 14. This table was produced by taking the ratios of final demands in the 1978 Yukon River Basin table to final demands in the 1978 Yukon table for each sector and multiplying these ratios by the final demands in the 1981 Yukon table to obtain absolute values for 1981 final demands for the Yukon River Basin. These final demands were then multiplied by the direct plus indirect coefficient matrix with households exogenous (Table 12) to produce the 1981 Yukon River Basin table (working backward in the fashion of equations III.13, III.10 and III.8).

In using the Yukon River Basin matrices of direct plus indirect coefficients for impact analysis (or projections of any kind), final demand estimates may be made independently for the Yukon River Basin and projections made on this basis. It is only when it is desireable to have Yukon and Yukon River Basin forecasts that are compatible that it becomes necessary to relate the final demands in the fashion described above. The user may go from a Yukon forecast to a Yukon River Basin forecast as

TABLE 10

Transactions Table * Yukon River Basin 1970
(In Thousands of Dollars)

Industry		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Total Int. Prod. 14	WPIC 15	E 16	G 17	GPCF 18	C 19	N 20	GRP 21	Total Prod. 22
Hard Rock Mining	I1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17720	132782	—	—	—	—	150502	150502
Placer Mining	I2	—	—	—	—	—	—	—	—	806	—	—	—	[illegible]	1052	—	4727	—	—	—	—	4727	6379
Oil and Gas	I3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Forestry	I4	170	—	—	—	—	—	—	—	—	—	—	—	25	195	—	—	12	—	—	—	12	207
Fishing, Hunting, Trapping and Subsistence	I5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	910	—	—	3720	—	4630	4630
Transportation	I6	14193	308	—	8	—	1373	7033	2572	15999	7966	3088	24	279	52207	—	—	2392	—	—	—	2392	54599
Construction	I7	584	99	—	13	—	11073	17474	3903	12530	11352	487	2021	4	67300	—	—	2116	10075	—	—	12191	79491
Utilities	I8	7177	11	—	5	—	642	570	347	697	968	987	809	261	12936	—	665	279	—	6605	—	7549	20485
Wholesale Trade	I9	2584	725	—	1	—	2230	2157	198	2031	6914	1657	1747	87	20631	—	—	22992	21438	—	—	44430	65061
Retail Trade	I10	56	62	—	—	1037	1400	1062	—	76	155	1640	115	907	6282	—	22095	6177	—	32311	—	60579	66780
Services	I11	9304	503	—	—	—	3079	2534	3110	1313	7017	9343	106	97	32604	—	17030	1993	—	19955	—	38922	68084
Finance, Insurance and Real Estate	I12	36	82	—	—	—	3090	3610	2920	3961	7107	6734	3057	493	31102	—	1260	—	—	11400	—	12702	43804
Manufacturing	I13	5125	17	—	—	—	87	25	176	32	907	55	17	48	6491	—	—	594	—	—	—	594	7085
Total Processing	14	39229	1661	—	29	1032	23071	35305	13642	37054	44365	16497	8764	2990	226130	17720	170972	36495	33913	73811	—	336309	562099
Indirect Taxes Less subsidies	15	840	—	—	0	4	1647	2702	-2	1	183	2380	3626	26	11292	—	—	—	—	—	—	—	11292
Other Operating Surplus	16	35730	—	—	-420	—	-21933	4929	—	1060	2039	13736	27080	1110	63861	—	—	—	—	—	—	—	63861
Depreciation	17	13096	—	—	920	—	33317	4179	—	114	122	4349	169	120	56440	—	—	9868	—	2934	—	12802	69446
Net Income of Unincorporated Business	18	—	1300	—	1	3594	—	880	199	92	794	2864	570	28	10058	—	—	—	—	6391	—	6391	16447
Labor Income	19	17053	1362	—	110	—	12852	19707	2351	10379	17031	27726	1207	815	122004	—	—	46180	—	—	—	46180	168282
Imports	20	25142	1854	—	1	—	5805	5295	4234	16761	7266	3835	352	2235	72090	275	—	6489	72980	6563	—	86317	158367
Total Final Payments	21	111364	4536	—	178	3598	31578	39558	6782	29207	22415	47587	39052	4535	338309	275	—	62665	72980	15918	—	150840	487657
Total Outlays	22	150592	6379	—	207	4630	54599	74861	20424	67061	66780	68084	47815	7005	562099	17603	170972	98160	106893	89629	—	487657	1049956

* Column and Row entries may not sum precisely to totals because of rounding

TABLE 11

Direct Coefficients Matrix

Yukon River Basin

		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Total Im. Prod. 14	WRC 15
Hard Rock Mining	I1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Placer Mining	I2	—	—	—	—	—	—	—	—	.012050	—	—	—	.119470	—	—
Oil and Gas	I3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Forestry	I4	.001130	—	—	—	—	—	—	—	—	—	—	—	.003530	—	—
Hunting, Trapping, Fishing and Subsistence	I5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Transportation	I6	.090350	.053040	—	.038030	—	.034240	.104630	.125000	.129500	.119000	.075250	.000550	.039410	—	—
Construction	I7	.053000	.023510	—	.563040	—	.302090	.229430	.301060	.300940	.299930	.000150	.011440	.000570	—	—
Utilities	I8	.047000	.001090	—	.0024150	—	.011790	.007510	.030570	.010400	.014400	.014040	.020040	.037100	—	—
Wholesale Trade	I9	.017160	.113020	—	.0014400	—	.040910	.030010	.009710	.036250	.103030	.025000	.039700	.013100	—	—
Retail Trade	I10	.006370	.009780	—	—	.322090	.037300	.014200	—	.001130	.002330	.034990	.002630	.075540	—	—
Services	I11	.061700	.070090	—	—	—	.054390	.024300	.152870	.010540	.103000	.000070	.003010	.012300	—	—
Finance, Insurance and Real Estate	I12	.006340	.013810	—	—	—	.056470	.040120	.143790	.050070	.187620	.105230	.079050	.056040	—	—
Manufacturing	I13	.034030	.062700	—	—	—	.003400	.000340	.000530	.000400	.013500	.000040	.000300	.006750	—	—

TABLE 12

Direct and Indirect Coefficients, Household Endogenous   Yukon River Basin

		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	[illegible]
Hard Rock Mining	I1	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Placer Mining	I2	0.000500	1.002989	0.000000	0.000329	0.000774	0.001126	0.000059	0.001753	0.013884	0.013070	0.002707	0.000719	0.131100	0.00000
Oil and Gas	I3	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Forestry	I4	0.001254	0.000012	0.00000	1.000002	0.000012	0.000010	0.000005	0.000038	0.000006	0.000053	0.000006	0.000003	0.003561	0.00000
Hunting, Trapping, Fishing and Subsistence	I5	0.00000	0.00000	0.00000	0.00000	1.000000	0.00000	0.00000	0.00000	0.00000	0.00000	0.000000	0.00000	0.00000	0.00000
Transportation	I6	0.123801	0.107302	0.00000	0.061754	0.046379	1.000000	0.169055	0.150170	0.300370	0.300079	0.051268	0.030490	0.081264	0.00000
Construction	I7	0.003632	0.091042	0.00000	0.113254	0.004130	0.320038	1.383780	0.148626	0.367532	0.370016	0.057551	0.130393	0.077612	0.00000
Utilities	I8	0.055480	0.000114	0.00000	0.027603	0.006475	0.030764	0.017280	1.051070	0.032040	0.030049	0.032955	0.024748	0.045337	0.00000
Wholesale Trade	I9	0.031361	0.131707	0.00000	0.022029	0.031285	0.068838	0.057572	0.045630	1.071847	0.140361	0.041708	0.051132	0.007105	0.00000
Retail Trade	I10	0.009612	0.017010	0.00000	0.003746	0.227113	0.037120	0.035496	0.016884	0.016932	1.038917	0.038317	0.009938	0.078491	0.00000
Services	I11	0.000198	0.103017	0.00000	0.013606	0.013938	0.008430	0.007654	0.382090	0.062387	0.153389	1.101746	0.015180	0.048732	0.00000
Finance, Insurance and Real Estate	I12	0.030845	0.047796	0.00000	0.017297	0.008486	0.104803	0.099194	0.320675	0.128172	0.181272	0.136940	1.093860	0.057008	0.00000
Manufacturing	I13	0.075215	0.007391	0.00000	0.000460	0.001327	0.000701	0.001387	0.018881	0.001896	0.014936	0.001716	0.000015	1.000090	0.00000

TABLE 13

Direct and Indirect Coefficients, Households Endogenous   Yukon River Basin

	.	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	14
Hard Rock Mining	I1	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Placer Mining	I2	0.005035	1.002410	0.00000	0.001075	0.000900	0.001822	0.001452	0.002230	0.013604	0.004030	0.001244	0.000097	0.121407	0.002048
Oil and Gas	I3	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Forestry	I4	0.001261	0.000018	0.00000	1.000012	0.000014	0.000020	0.000013	0.000042	0.000013	0.000061	0.000014	0.000006	0.003566	0.000029
Hunting, Trapping, Fishing and Subsistence	I5	0.011211	0.010447	0.00000	0.018554	1.003145	0.017298	0.014709	0.011868	0.012947	0.014111	0.013365	0.004418	0.007645	0.050912
Transportation	I6	0.152561	0.130213	0.00000	0.109547	0.054400	1.130648	0.207951	0.222750	0.341730	0.244427	0.005994	0.041830	0.103950	0.131173
Construction	I7	0.110260	0.140103	0.00000	0.200301	0.099204	0.409259	1.453035	0.404357	0.424332	0.445879	0.120310	0.141039	0.113515	0.239130
Utilities	I8	0.001635	0.032487	0.00000	0.070000	0.013012	0.061120	0.051702	1.079937	0.052154	0.061960	0.053134	0.039047	0.063173	0.110000
Wholesale Trade	I9	0.050641	0.149753	0.00000	0.054735	0.036694	0.096505	0.003004	0.060037	1.093912	0.164627	0.064731	0.030929	0.000313	0.007569
Retail Trade	I10	0.114359	0.114620	0.00000	0.177095	0.256498	0.190727	0.164672	0.127347	0.137901	1.150703	0.195103	0.047206	0.109923	0.475775
Services	I11	0.174449	0.181459	0.00000	0.154609	0.057044	0.219906	0.182111	0.293536	0.160040	0.359517	1.203371	0.048782	0.107060	0.307219
Finance, Insurance and Real Estate	I12	0.103501	0.111773	0.00000	0.130917	0.050664	0.210734	0.109761	0.292349	0.197460	0.267683	0.218303	1.119914	0.143877	0.311042
Manufacturing	I13	0.037040	0.005102	0.00000	0.003494	0.003041	0.005530	0.003006	0.012022	0.003014	0.017234	0.003901	0.001570	1.010140	0.000320
Households	14	0.271260	0.252770	0.00000	0.440914	0.076097	0.418535	0.257039	0.207149	0.313269	0.341411	0.323361	0.106091	0.104904	1.232094

TABLE 14

Transactions Table * Yukon River Basin 1981
(In Thousands of Dollars)

Industry		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Total Int. Prod. 14	VPIC 15	X 16	G 17	GFCF 18	C 19	M 20	GDP 21	Total Prod. 22
Hard Rock Mining	I1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3659	204928	--	--	--	--	208587	208587
Placer Mining	I2	--	--	--	--	--	--	--	--	1182	--	--	--	1176	2358	--	45702	--	--	--	--	45702	48060
Oil and Gas	I3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Forestry	I4	236	--	--	--	--	--	--	--	--	--	--	--	35	270	--	--	17	--	--	--	17	287
Fishing, Hunting, Trapping and Subsistence	I5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1162	--	--	4533	--	5695	5695
Transportation	I6	19659	2592	--	11	--	1895	10915	3409	23469	10120	2239	32	388	74730	--	--	3454	--	--	--	3454	78184
Construction	I7	809	745	--	18	--	15856	24350	5174	18391	16963	547	3754	6	86612	--	--	3055	14650	--	--	17705	104317
Utilities	I8	9941	81	--	7	--	919	794	990	1021	1229	1327	1156	366	17834	--	828	317	--	8101	--	9246	27080
Wholesale Trade	I9	3579	5461	--	4	--	3199	3005	263	3566	8657	2227	2316	121	32397	--	--	13193	32779	--	--	65972	98369
Retail Trade	I10	77	470	--	--	1269	2131	1480	--	111	197	2216	153	704	8809	--	27487	8918	--	39629	--	76034	84843
Services	I11	12887	3791	--	--	--	4409	3587	4134	1926	8915	7181	140	121	47093	--	15023	2877	--	23808	--	41708	88801
Finance, Insurance and Real Estate	I12	58	616	--	--	--	4431	5030	3882	5011	9131	9051	4070	560	42639	--	1578	--	--	14036	--	15614	58253
Manufacturing	I13	7098	130	--	--	--	125	35	234	47	1152	75	23	67	8986	--	--	858	--	--	--	858	9844
Total Processing	14	54317	13807	--	40	1269	32965	49197	18086	55526	56364	24862	11652	3543	321729	3659	296708	52609	47429	90107	--	490592	812321
Indirect Taxes Less Subsidies	15	1163	--	--	11	5	2350	3849	-3	1	233	2940	4820	36	15415	--	--	--	--	--	--	--	15415
Other Operating Surplus	16	48803	--	--	-1276	--	-31407	9655	--	2729	2565	16500	36015	1821	85404	--	--	--	--	--	--	--	85404
Depreciation	17	18139	--	--	1357	--	47709	5824	--	167	155	5845	224	167	79588	--	--	13092	--	3592	--	16683	96271
Net Income of Unincorporated Business	18	--	10095	--	1	4421	--	842	264	134	1008	3850	691	39	21346	--	--	--	-	7811	--	7811	29157
Labour Income	19	51322	10111	--	153	--	18131	27573	3117	15225	15285	29942	4371	1133	176363	--	--	66683	--	--	--	66683	243046
Imports	20	34824	13968	--	1	--	8427	7378	5613	24586	9231	4859	482	3105	112476	47	--	9251	102066	7960	--	119327	231803
Total Final Payments	21	154252	34174	--	247	4426	45219	55122	8992	42843	28478	63936	46603	6301	490592	47	--	89020	102066	19363	--	210504	701096
Total Outlays	22	208589	48060	--	287	5695	78184	104319	27079	98369	84842	88798	58255	9845	812321	3706	296708	141717	149495	109470	--	701096	1513417

* Column and Row entries may not sum precisely to totals because of rounding

described above, or the process may be reversed.

E. DISAGGREGATION OF THE MINING SECTOR

1. Purpose

The desire of the Yukon River Basin Study to have a separate sector for the placer mining industry has been referred to several times in the preceding sections. The main reason for developing a separate Placer Mining sector was because its growth and decline was influenced by different circumstances to what influenced the hard rock mining sector. Gold price fluctuations, it was argued, did not coincide with price movements for ores produced in the hard rock sector. In addition, it was argued that the placer mining industry made a distinct contribution to the Yukon economy and that it would be useful and of interest to identify this contribution.

2. Methodology

It was initially thought that that the hard rock and the placer mining industries were combined in the worksheets used to construct the Yukon Economic Accounts. This belief appeared to be confirmed in conversation with those DIAND employees who had constructed the accounts. We were also informed that the mining sector totals in the Price-Waterhouse surveys included the placer mining industry. Therefore, additional resources were obtained to carry out this additional project component.

It was decided to procede by sending questionnaires to firms in the placer mining industry in order to obtain the totals which could be used to separate this sector out from the rest of the mining industry. However, as more information became available, it became clear that the placer mining sector was not included at [illegible] in the worksheets that were used to construct the economic accounts. Specifically when the total figures obtained from the hard rock mining companies by questionnaire summed to those presented in the Price-Waterhouse surveys and the Price-Waterhouse figures were identical to those in the DIAND worksheets, it was apparent that the placer mining industry had been neglected altogether in the preparation of the Yukon Economic Accounts. Consequently, it turned out that a placer mining sector was "created" from the information contained in the questionnaires returned from the firms in that industry rather than being used to "disaggregate" this sector from the totals contained in the DIAND worksheets. However, as it turned out the amount of resources required to create the sector was equal to, if not more than, what would have been required for disaggregation. The fact that Placer Mining was not part of the mining sector in the DIAND worksheets meant that there were no control totals for the combined sectors and additional information with respect to total placer mining production had to be obtained.

The placer mining sector was constructed by use of the questionnaires and by information provided by DIAND personnel in Whitehorse regarding total gold production by the industry (See section III.C.2.ii.b.5.). A total of 28 questionnaires were returned by firms in the placer mining industry. As indicated in the discussion of the returned questionnaires, the quality of those received from the placer mining firms was judged to be very good (See section III.C.2.ii.b.3.). The information contained therein was used to produce a column of input coefficients, that is, allocation of purchases per dollars worth of input. The total value of the output obtained from DIAND was then multiplied by these column coefficients to obtain absolute values for the entries in the Placer Mining column of the 1978 Yukon input-output table. The sales distribution by the placer mining sector for 1978 was derived from the questionnaires and from estimates made by DIAND employee Blake Baxter in telephone conversation with him and from data provided by his office.

The way in which the placer mining sector was created is very much like most sectors are developed in regional input-output tables. That is, up until very recently data of the type contained in the DIAND worksheets has simply not been available and most information for all sectors had to be collected on a first hand basis. Given the quality of the returns from this sector, coupled with the fairly large number of returns, the input coefficients derived from them are probably quite representative. Thus the entries in the direct plus indirect coefficient matrices for this column are likely as good as any except those for the hard rock mining industry. The row is probably less reliable with respect to the distribution of sales. This has to do with determining where the gold goes which does not become part of the DIAND records. The estimates provided by the DIAND officials responsible for these records would appear to be the best available.

IV. APPLICATIONS OF INPUT-OUTPUT ANALYSIS

A. SPECIFIC APPLICATIONS

As discussed in preceding sections, a forecast, an assessment of an impact or an evaluation of a scenario is made by developing (or hypothesizing) a level and/or composition of final demand which differs from that used in preparing the transactions table for the base year. These final demands are then multiplied by one of the direct plus indirect coefficient matrices to produce the gross outputs associated with this forecast or hypothesized set of demands, as in equation III.13. The input-output table that is descriptive of the economy at a time when these final demands have been realized is constructed by working back through equation III.10 to III.8. The prepartion of the 1981 Yukon table represents an application of this procedure. The known and estimated final demands for each sector of the Yukon economy were multiplied by the direct plus indirect coefficients matrix with households exogenous to produce the requisite gross outputs. The table was then produced as indicated above.

As a separate exercise an additional experiment was conducted using the model with households exogenous in which exports of the two mining sectors were increased. The exports of the hard rock sector were increased by 64 percent while that of the placer mining sector was increased by 50 percent over their 1978 values and no other changes were made to the 1978 level of final demands. As expected, income (factor payments) and output of these sectors rose substantially but the income (factor payments) and output of most other sectors increased as well. The results of this experiment are summarized in Table 15.

TABLE 15 IMPACT ON OUTPUT AND INCOME (FACTOR PAYMENTS) OF A 50 PERCENT INCREASE IN THE EXPORTS OF THE PLACER MINING SECTOR AND A 64 PERCENT INCREASE IN EXPORTS FROM THE HARD ROCK MINING SECTOR

		Increase in Output and Income Absolute $(000)	
	Percent	Output	Income
Hard Rock	50	75,299	53,543
Placer	34	1,010	718
Manufacturing	41	4,796	3,069
Forestry	37	758	678
Utilities	19	4,198	1,394
Transportation	16	9,438	5,464
Services	10	6,801	4,896
Construction	6	5,083	2,678
FIRE	6	2,690	2,152
W. Trade	3	2,462	1,073
R. Trade	1	762	256
Oil and Gas	0	0	0
Hunting	0	0	0

Considerable care must be used in interpreting the output of this experiment. As an experiment only it identifies the direct plus indirect increases in output and income required to support the increased demand for the mining sectors alone. As a projection of the impact on the economy of an increase in mining exports of the magnitudes specified, it is totally unrealistic. This is because an increase in mining exports of this magnitude would induce a substantial round of consumption spending which would set in motion all sorts of additional activity, increases in public expenditures, etc. In this experiment all these induced effects have been deliberately ignored. In the production of the 1981 tables these effects were taken into account by using the actual and estimated final demands for all sectors.

This exercise serves to indicate the care that must be taken in developing new final demands for impact assessment, scenario testing or forecasting. The induced impact of any change in exogenous demand on other final demand categories must be taken explicitly into account. These relationships between final demand categories might well be determined first through the use of an income determination model which is compatible with the input-output model.

One final point to consider is that of prices. If constant dollar relationships are desired, the user should convert the final demand figures for any forecast into dollars of the base year before producing the new table. If nominal dollar relationships are preferred, nominal dollar final demands should be sued. Both the 1978 and the 1981 tables produced in this report are stated in nominal dollars.

B. MULTIPLIER ANALYSIS

Various multipliers can be developed from input-output models. Output multipliers and income multipliers are two types of multipliers that are frequently obtained.

1. Output Multipliers

Output multipliers are very easily derived. They are simply the sums of the entries in the columns of the interindustry portions of direct plus indirect coefficients matrices. These sums represent the sums of outlays required for produced inputs directly and indirectly, for each sector, to support $1.00 of delivery to final demand by each of the processing sectors. The output multipliers are shown in Table 16. The multipliers are larger for those matrices in which the household sector is endogenous as is to be expected. Although the labour income row itself is excluded, the interaction of the household sector with the other producing sectors in these matrices increases the size of many of the coefficients. The ouptut multiplier is not a particularly useful concept, however, except as an indicator of the degree of structural dependence of each sector on the rest of the industries in the economy. For impact analysis the interest is usually with the income generating effects of some proposed course of action.

Table 16 Output Multipliers for Yukon and Yukon River Basin Input-Output Models *

Sector	Yukon		Yukon River Basin	
	Households		Households	
	Exogenous	Endogenous	Exogenous	Endogenous
Hard Rock	1.493	1.894	1.451	1.850
Placer	1.506	1.873	1.506	1.878
Oil and Gas	1.321	5.818	—	—
Forestry	1.190	1.847	1.261	1.921
Hunting	1.474	1.586	1.474	1.586
Transportation	1.735	2.188	1.736	2.352
Construction	1.828	2.345	1.826	2.352
Utilities	2.090	2.495	2.090	2.512
W. Trade	1.978	2.403	1.978	2.439
R. Trade	2.127	2.612	2.127	2.630
Services	1.444	1.923	1.444	1.920
F.I.R.E.	1.342	1.500	1.342	1.450
Manufacturing	1.543	1.848	1.613	1.885

---

* Generally the larger the output multiplier the greater is the extent of structural dependence. Ancmolies arise in immature sectors such as the oil and gas industry where the labour bill is several times the total output.

2. Income Multipliers

Two varieties of income multipliers are typically derived from input-output tables. Those for the Yukon and Yukon River Basin are shown in Tables 17 and 18. The first, or Type I, multiplier is expressed as the ratio of the direct plus the indirect income change to the direct income change resulting from a one dollar increase in final demand for each processing sector. It is calculated as follows. The direct income change for each sector is given by the household row coefficient of the direct coefficients table with households included in the transactions matrix (from row 19 of Table 5). These coefficients are reproduced as column one of Table 17. The direct plus indirect income change is obtained by multiplying each column entry from the direct plus indirect coefficients matrix with households exogenous (Table 6) by the supplying industries corresponding row entry of the direct coefficients matrix with households included (column one of Table 17). The product of this calculation is entered as column two of Table 17. The indirect income change, recorded in column 3 of Table 17, is obtained by subtracting the entries in column one of Table 17 from the entries in column two of Table 17. The Type I multiplier, recorded in column four of Table 17 is obtained by dividing column two of Table 17 by column one of Table 17.

The Type II income multiplier is the ratio of the direct, indirect and induced income change to the direct income change due to a one dollar increase in final demand. The Type II multiplier provides a more complete summary of the eventual consequences of an increase in final demand because it takes into account the repercussionary effects of secondary rounds of consumer spending in addition to the direct and indirect interindustry effects. In column five of Table 17 is listed the direct, indirect and induced income change for each sector. This column is the household row of the direct plus indirect coefficients matrix with households endogenous (Table 7). The induced income change, shown in column six of Table 17, is obtained by subtracting the direct plus indirect income change from column two from the totals in column five. The indirect plus induced income change is the sum of the entries in column three plus column six and is recorded in column seven of Table 17. Finally the Type II multiplier, shown in column 8, is the result of dividing the entries in column five by those in column one of Table 17. The interpretation of Table 18 is identical to that of Table 17.

TABLE 17 TYPE I AND TYPE II INCOME MULTIPLIERS FOR THE YUKON

INCOME MULTIPLIERS *

INDUSTRY	DIRECT INCOME CHANGE	DIRECT AND INDIRECT INCOME CHANGE	INDIRECT INCOME CHANGE	TYPE I MULTIPLIER	DIRECT, INDIRECT AND INDUCED INCOME CHANGE	INDUCED INCOME CHANGE	INDIRECT AND INDUCED INCOME CHANGE	TYPE II MULTIP IE
HARD-ROCK MINING	0.15	0.22	0.07	1.43	0.27	0.05	0.12	1.76
PLACER MINING	0.13	0.20	0.07	1.53	0.25	0.05	0.12	1.88
FORESTRY	0.33	0.36	0.03	1.09	0.44	0.08	0.11	1.33
OIL AND GAS	2.42	2.46	0.04	1.02	3.03	0.56	0.61	1.25
TRANSPORTATION	0.15	0.25	0.10	1.71	0.30	0.06	0.16	2.10
CONSTRUCTION	0.17	0.28	0.12	1.72	0.35	0.06	0.18	2.11
UTILITIES	0.07	0.22	0.15	3.09	0.27	0.05	0.20	3.79
WHOLESALE TRADE	0.10	0.23	0.14	2.41	0.29	0.05	0.19	2.96
RETAIL TRADE	0.11	0.27	0.15	2.36	0.33	0.06	0.21	2.90
SERVICES	0.21	0.27	0.05	1.26	0.33	0.06	0.11	1.54
FINANCE, INSURANCE AND REAL ESTATE	0.05	0.09	0.04	1.84	0.11	0.02	0.06	2.26
MANUFACTURING	0.07	0.17	0.10	2.33	0.21	0.04	0.13	2.86

*The calculations were carried out to several decimal places in the computer and are shown in rounded form here.

TABLE 18 TYPE I AND TYPE II INCOME MULTIPLIERS FOR THE YUKON RIVER BASIN

INCOME MULTIPLIERS *

INDUSTRY	DIRECT INCOME CHANGE	DIRECT AND INDIRECT INCOME CHANGE	INDIRECT INCOME CHANGE	TYPE I MULTIPLIER	DIRECT, INDIRECT AND INDUCED INCOME CHANGE	INDUCED INCOME CHANGE	INDIRECT AND INDUCED INCOME CHANGE	TYPE II MULTIPLIE
HARD-ROCK MINING	0.15	0.22	0.07	1.47	0.27	0.05	0.12	1.81
PLACER MINING	0.13	0.21	0.08	1.60	0.25	0.05	0.12	1.97
FORESTRY	0.32	0.36	0.04	1.13	0.45	0.08	0.13	1.39
OIL AND GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANSPORTATION	0.23	0.34	0.11	1.46	0.42	0.08	0.19	1.80
CONSTRUCTION	0.16	0.29	0.13	1.81	0.36	0.07	0.20	2.23
UTILITIES	0.07	0.23	0.16	3.33	0.29	0.05	0.22	4.10
WHOLESALE TRADE	0.09	0.25	0.16	2.70	0.31	0.06	0.22	3.33
RETAIL TRADE	0.11	0.28	0.17	2.53	0.34	0.06	0.23	3.12
SERVICES	0.21	0.26	0.06	1.28	0.32	0.06	0.12	1.58
FINANCE, INSURANCE AND REAL ESTATE	0.05	0.09	0.04	1.90	0.11	0.02	0.06	2.34
MANUFACTURING	0.07	0.15	0.08	2.15	0.18	0.03	0.12	2.64

*The calculations were carried out to several decimal places in the computer and are shown in rounded form here.

Income multipliers are useful analytic and policy tools but they must be used with care. The Type I and Type II multipliers for example indicate the ratio of the direct plus indirect income change to direct income and the ratio of direct plus indirect plus induced income to direct income change respectively, resulting from a one dollar increase in final demand. Thus these multipliers indicate the amount by which income will increase over the direct labour payment, not the amount by which total income will increase over an initial increase in some final demand category.

Income multipliers can also be used to select activities on which to spend when there is a limited fund available for expansion purposes. The sector with the highest income multiplier will generate the greatest total income per payroll dollar for example. In this regard it is sometimes thought that the most labour intensive industries will generate the greatest labour income. This is not necessarily so. Of the mature sectors in the Yukon economy, services has the highest labour-output ratio in the Yukon model but its Type I and Type II multipliers are relatively small. Utilities which has a relatively low direct labour input has the highest multipliers. The difference is that the utilities sector has more extensive interactions with other sectors in the Yukon economy than does services. Placer Mining and Hard Rock mining also have relatively low multipliers. Each has substantial interactions on the input side but both have little or no interaction on the output side.

The magnitude of the multipliers fall easily within the range of those conventionally observed in input-output analysis. For the Yukon, Type II multipliers run from a low of 1.25 for the immature oil and gas sector to 3.79 for utilities. In his study of Saskatchewan, Kulshreshtha (see footnote 5) surveyed several input-output studies done of regional economies in the U.S. and Canada over the past several years. In these studies, Type II income multipliers were observed to vary from 1.33 to 6.71. An unpublished 44 sector input-output table of the Saskatchewan economy derived from the Statistics Canada national input-output table produced Type II income multipliers ranging from 1.39 to 8.10. [9] The magnitude of the multipliers will differ depending on the definition of the sectors, the aggregation, the size of the economy, the geographical size of the area under study, and its proximity to other developed areas. Thus multipliers are not often strictly comparable from one input-output table to the next. The large geographical size of the Yukon coupled with its isolation facilitates a high degree of interaction between the sectors of its residentiary industries which helps to overcome its small economic size. It will be noted that the sectors with the largest multipliers are those which have the greatest interaction with other industries in the Yukon as indicated by the larger entries in the indirect income change column of Table 17.

[9] Prepared by L.V. St. Louis, Department of Economics, University of Saskatchewan, Saskatoon, 1983.

V. MODIFICATIONS OCCASIONED BY NEW INFORMATION FOR THE PLACER MINING INDUSTRY

In June 1983, after completion of the Yukon and Yukon River Basin input-output tables, a report prepared by R.L. Debicki of DIAND entitled Placer Mining Industry in Yukon and Atlin Mining Division, British Columbia, Whitehorse, February 29, 1983 was obtained. This study provided a more comprehensive analysis of the exports of gold from this sector than had previously been available from DIAND records.

It was decided, in consultation with the Yukon Department of Economic Development and Intergovernmental Relations, to utilize this information by producing new transactions tables using the previously derived inverses. Consequently 1978 and 1981 Yukon and Yukon River Basin transactions tables were prepared using the new gold export data from the Debicki study along with the remainder of the original 1978 and 1981 final demand data. Table 19 is the 1978 Yukon table obtained in this fashion. It differs from Table 4 in that Placer Mining exports have been increased from $1.247 million to $4.7 million. As a consequence the entries in a number of other cells also increased by small amounts reflecting increased interaction with the Placer Mining sector. All of the other transactions tables in the report, that is Tables 8, 10 and 14 were produced using the gold export data for the Placer Mining sector from the Debicki study. Table 4 was left as originally derived since all of the references in the text refer to the numbers in this basic table.

TABLE 19

Transactions Table * Yukon 1978
(In Thousands of Dollars)

Industry		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Total Int. Prod. 14	WPIC 15	X 16	G 17	GFCF 18	C 19	M 20	GDP 21	Total Prod. 22
Hard Rock Mining	I1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17330	133711	—	—	—	—	150591	150591
Placer Mining	I2	—	—	—	—	—	—	—	—	864	—	—	—	861	1725	—	4700	—	—	—	—	4700	6425
Oil and Gas	I3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	57	—	—	—	—	57	57
Forestry	I4	170	—	—	—	—	—	182	—	—	—	—	—	1596	1948	—	—	119	—	—	—	119	2067
Fishing, Hunting, Trapping and Subsistence	I5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	934	—	—	3696	—	4630	4630
Transportation	I6	14193	347	6	80	—	1412	8549	2714	17155	9106	1704	26	284	55737	—	—	2580	—	—	—	2580	58317
Construction	I7	584	100	1	130	—	11812	19074	4119	13044	15396	436	3030	4	68171	—	—	2302	11390	—	—	13700	81833
Utilities	I8	7177	11	—	5	—	685	621	780	748	1116	1050	932	260	13410	—	724	238	—	7187	—	8149	21559
Wholesale Trade	I9	2584	730	2	3	—	2383	2354	209	2407	7857	1775	1049	89	22463	—	—	24406	24961	—	—	49447	71910
Retail Trade	I10	56	63	1	—	1032	1590	1160	—	81	179	1766	124	516	6545	—	25487	7183	—	37571	—	70441	77986
Services	I11	9304	507	—	—	—	3205	2810	3291	1408	8891	5724	113	89	34622	—	12983	2143	—	21027	—	36153	70775
Finance, Insurance and Real Estate	I12	36	82	—	—	—	3300	3940	3091	4240	8287	7215	3291	409	33900	—	1309	—	—	11810	—	13119	47019
Manufacturing	I13	9403	17	—	—	—	93	20	106	35	1046	59	18	49	10934	—	—	635	—	—	—	635	11569
Total Processing	14	43507	1057	10	218	1032	24558	38710	14399	40991	51150	19817	9403	4185	249434	17330	179607	39686	36359	81291	—	354322	603756
Indirect Taxes less subsidies	15	840	—	7	76	4	1757	3016	-2	1	211	2344	3091	43	17187	—	—	—	—	—	—	—	17187
Other Operating Surplus	16	35234	—	-193	-9170	—	-23397	7602	—	1995	2320	13150	29070	2139	58749	—	—	—	—	—	—	—	58749
Depreciation	17	13096	—	—	9832	—	35578	6602	—	122	141	4659	181	196	68406	—	—	9861	—	3240	—	13101	81507
Net Income of Unincorporated Business	18	—	1350	—	10	3594	—	680	210	99	915	3060	550	46	10509	—	—	—	—	7047	—	7047	17556
Labour Income	19	37053	1352	220	1096	—	13543	21636	2402	11130	13874	23864	3527	1331	131100	—	—	50726	—	—	—	50726	181334
Imports	20	20863	1067	13	13	—	6270	5597	4469	17973	8379	3872	389	3649	73363	275	—	6909	78244	7101	—	92619	165902
Total Final Payments	21	107086	4569	47	1845	3598	33759	43112	7159	31318	25847	50950	37615	7404	254322	225	—	67056	78244	17408	—	162993	517315
Total Outlays	22	150593	6425	57	2067	4630	58317	81830	21559	71909	77005	70755	47019	11569	683756	17903	179607	106742	114603	98759	—	517315	1171071

* Column and Row entries may not sum precisely to totals because of rounding

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APPENDIX

QUESTIONNAIRE "A"

Please send completed questionnaire to:

Mr. Colin Heartwell, Director
Economic Research and Planning Branch
Department of Tourism and Economic Development
Box 2703
Whitehorse, Yukon

PLEASE RETURN THE COMPLETED QUESTIONNAIRE BY JUNE 15, 1982.
A stamped return envelope is provided for this purpose.

The information requested is for the Calendar Year 1981. If you are not able to provide information for 1981 please provide it for 1980 if possible. Likewise if your records are arranged by fiscal year, you may provide it on this basis. Please indicate immediately below which basis you have used by checking (✓) or filling in the appropriate blanks.

1. Year: Calendar Year 1981 ________ 1980 ________

   Fiscal Year

   From ______________ ______ to ______________ ______
   month year month year

2. Name and address of establishment:

   ____

   ____

   ____

3. Respondent's name and position:

   ____

   ____

   Questions 4 to 9 are concerned with your sales. If your records do not provide precise answers to questions 4-9 please provide your best estimate.

4. Total sales from all products and services made by establishment named above during year $ __________

5. Of the total sales identified in question 4, how many dollars sales were made to buyers whose places of business (in the case of firms) or residences (in the case of individuals) are outside the Yukon? $ __________

6. Subtract the total entered on line 5 from the total entered on line 4 and enter that total here. This represents sales to all Yukon buyers. $ ________

7. Of the total identified in question 6, how many dollars sales were made to Yukon business firms? (For purposes of this answer exclude sales made to individuals for their own personal use as well as to all government agencies or departments except Crown Corporations. Crown Corporations which produce a product or provide a service in the Yukon that is sold commercially should be considered the same as private business firms. NOTE: The Post Office should be considered a Crown Corporation.) $ ________

8. Subtract the total entered on line 7 from the total entered on line 6 and enter the total here. (This total represents sales to individuals resident in the Yukon as well as sales to all government departments or agencies in the Yukon with the exception of Crown Corporations.) $ ________

9. In this question, please allocate sales made to firms (the total from question 7) summed according to the type of industry the buying firms are classified as being in. The eleven industrial classifications being used are: 1. Hard Rock Mining 2. Placer Mining 3. Forestry 4. Transportation 5. Construction 6. Electric, Water, Postal and Communications Utilities 7. Wholesale Trade 8. Retail Trade 9. Finance, Insurance or Real Estate Services 10. Other Services 11. Manufacturing

NOTE: If you are unsure of the industrial classification please list the name of the firm to which sales are made.

For this question sales figures should be shown after any discounts and allowances, should be FOB your establishment and should exclude any excise taxes and freight charges. If freight charges cannot be excluded or if you deliver in your own trucks please indicate.

			Transportation Included?		
			No	Yes	
	Sales ($)	Sales to Type of Industry		Commercial	Self delivered
9A					
B					
C					
D					
E					
F					

G					
H					
I					
J					

10. If purchased transportation was included in your answer to question 9 and/or if you delivered any of your products in your own vehicles, provide totals (or estimates) of the market value of these transport services.

Purchased transportation $

Self Delivery $

Questions 11 to 18 are concerned with your expenditures. Once again, if your records do not permit precise answers, please provide your best estimates.

11. What was the total of all purchases of products or commercial services made during the year by your firm directly from business firms and individuals whose places of business are outside the Yukon? $

12. What was the total of all purchases of products and services made by your firm from other business firms in the Yukon? (For purposes of this answer, Crown Corporations including the Post Office should be considered the same as private business firms.) $

13. Of the total expenditures identified in question 12 how many dollars were spent to purchase new investment goods?

A. New Buildings $

B. New Machinery $

C. New Vehicles $

D. Other (specify) $

14. Between the beginning and the end of the year in question, did your physical inventory of your product(s):

increase decrease no change

If you indicated either an increase or a decrease what was the dollar value of this change stated in terms of the prices you were charging at the end of the year? $

15. Between the beginning and the end of the year in question, did your physical inventory of materials and supplies used in your business:

________ increase   ________ decrease   ________ no change

If you indicated either an increase or a decrease what was the dollar value of this change stated in terms of prices you were paying at the end of the year? $ ________

16. What was the total of your depreciation allowance during the year? $ ________

17. What was the average number of full time workers employed by your firm during the year? This figure should include both wage and salary employees-workers as well as managers, proprietors etc. Two people who work ½ time should be counted as one worker. ________

18. What were the total wages and salaries paid by your firm during the year?

To workers who were residents of the Yukon $ ________

To non-resident workers $ ________

NOTE: For purposes of this question a resident should be considered as anyone who is physically present in the Yukon for one month or longer during the time of employment. A non-resident should be considered as anyone who lives outside the Yukon, does not establish residence while working in the Yukon but rather stays in hotels or other temporary accommodations and whose presence in the Yukon is short term, i.e. less than one month.

QUESTIONNAIRE "B"

Please send completed questionnaire to:

Mr. Colin Heartwell, Director
Economic Research and Planning Branch
Department of Tourism and Economic Development
Box 2703
Whitehorse, Yukon

PLEASE RETURN COMPLETED QUESTIONNAIRE BY JUNE 15, 1982.

The information requested is for the Calendar Year 1981. If you are not able to provide information for 1981 please provide it for 1980 if possible. Likewise if your records are arranged by fiscal year, you may provide it on this basis. Please indicate immediately below which basis you have used by checking (✓) or filling in the appropriate blanks.

1. Year: Calendar Year 1981 ________ 1980 ________

   Fiscal Year

   From ____________ ______ to ____________ ______
   month year month year

2. Name and address of establishment:

   ____

   ____

3. Respondent's name and position:

   ____

   ____

If your records do not permit precise answers to the following questions, please provide your best estimate.

Questions 4 through 13 pertain to sales.

4. Total sales from all products and services from Yukon operations by firm named above. $ ________

5. Of the total sales identified in question 4, how many dollars sales were made to buyers to whom your product was sent to a destination outside the Yukon? $ ________

6. Subtract the total entered in question 5 from the total entered in question 4. This represents sales from your Yukon operations to all Yukon buyers. $ ________

7. With respect to the sales identified in question 5, does this figure include transportation charges? ____ yes ____ no

8. If yes, what was the total value of the transportation charges? $ ________

If you made no sales to Yukon buyers, go directly to question 14.

9. Of the total sales made to Yukon buyers (question 6) how many dollars sales were made to Yukon business firms? (For purposes of this answer exclude sales made to individuals for their own personal use as well as to all government agencies or departments except Crown Corporations. Crown Corporations which produce a product or provide a service in the Yukon that is sold commercially should be considered the same as private business firms. NOTE: The Post Office should be considered a Crown Corporation.) $ ________

10. Subtract the total entered in question 9 from the total entered in question 6. $ ________

11. Of the total listed to question 10, identify sales to the following buyers:

    Households (or Individuals for personal use) $ ________
    Governments (except Crown Corporations) $ ________
    Other (specify) ____________________ $ ________

12. In this question, allocate sales to Yukon business firms (the total from question 9) summed according to the type of industry the buying firms are classified as being in. The eleven industrial classifications being used are: 1. Hard Rock Mining 2. Placer Mining 3. Forestry 4. Transportation 5. Construction 6. Electric, Water, Postal and Communications Utilities 7. Wholesale Trade 8. Retail Trade 9. Finance, Insurance or Real Estate Services 10. Other Services 11. Manufacturing

    NOTE: If you are unsure of the industrial classification please list the name of the firm to which sales are made.

    For this question sales figures should be shown after any discounts and allowances, should be FOB your establishment and should exclude any excise taxes and freight charges. If freight charges cannot be excluded or if you deliver in your own trucks please indicate.

	Sales ($)	Sales to Type of Industry	Transportation Included? No	Yes Commercial	Yes Self delivered
12A					
12B					
12C					
12D					
12E					
12F					
12G					
12H					
12I					
12J					

13. If purchased transportation was included in your answer to question 12 and/or if you delivered any of your products in your own vehicles, provide totals for the market value of these transport services.

Purchased Transportation $ ____________

Self Delivery $ ____________

Questions 14 through 24 pertain to expenditures or purchases.

14. What was the total of all purchases of products or commercial services made during the year by your firm directly from business firms and individuals whose places of business are outside the Yukon? $ ____________

If you made no purchases from Yukon suppliers go directly to question 18.

15. What was the total of all purchases of products and services for your Yukon operation made by your firm from other business firms in the Yukon? (For purposes of this answer, Crown Corporations, including the Post Office, should be considered as private business firms.) $ ____________

16. Of the total expenditure identified in question 15 how many dollars were spent to purchase new investment goods from Yukon business firms?

A. New Buildings $ ________

B. New Machinery $ ________

C. New Vehicles $ ________

D. Other (specify) ________ $ ________

17. Subtract the total of (A + B + C + D) identified in question 16 from the total listed in question 15. This sum represents total purchases of materials, supplies, transportation, services and other expendables from Yukon business firms. $ ________

Please allocate this total according to the type of industry the selling firms are classified as being in. (Use the classification provided for question 12.)

	Purchases ($)	Purchases from Type of Industry
17A		
17B		
17C		
17D		
17E		
17F		
17G		
17H		
17I		

18. Between the beginning and the end of the year in question did your physical inventory of your product(s) produced in the Yukon:

________ increase ________ decrease ________ no change

If you indicated either an increase or a decrease what was the dollar value of this change stated in terms of the prices you were charging at the end of the year? $ ________

19. Between the beginning and the end of the year in question did your physical inventory of materials and supplies used in your Yukon operation:

______ increase ______ decrease ______ no change

If you indicated either an increase or a decrease what was the dollar value of this change stated in terms of the prices you were paying at the end of the year? $ ______

20. What was the total of your depreciation allowance on your Yukon operations during the year? $ ______

21. What was the average number of full time workers employed by your firm during the Year? This figure should include both wage and salary employees-workers as well as managers, proprietors etc. Two people who work ½ time should be counted as one worker. ______

22. What were the total wages and salaries paid by your Yukon operation during the year:

To workers who were residents of the Yukon $ ______

To non-resident workers $ ______

NOTE: For purposes of this question a resident should be considered as anyone who is physically present in the Yukon for one month or longer during the time of employment. A non-resident should be considered as anyone who lives outside the Yukon, does not establish even a temporary residence while working in the Yukon but rather stays in hotels or other temporary accommodations and whose presence in the Yukon is short term, i.e. less than one month.

23. What was the sum of taxes paid during the year to all levels of government in the Yukon other than income taxes? $ ______

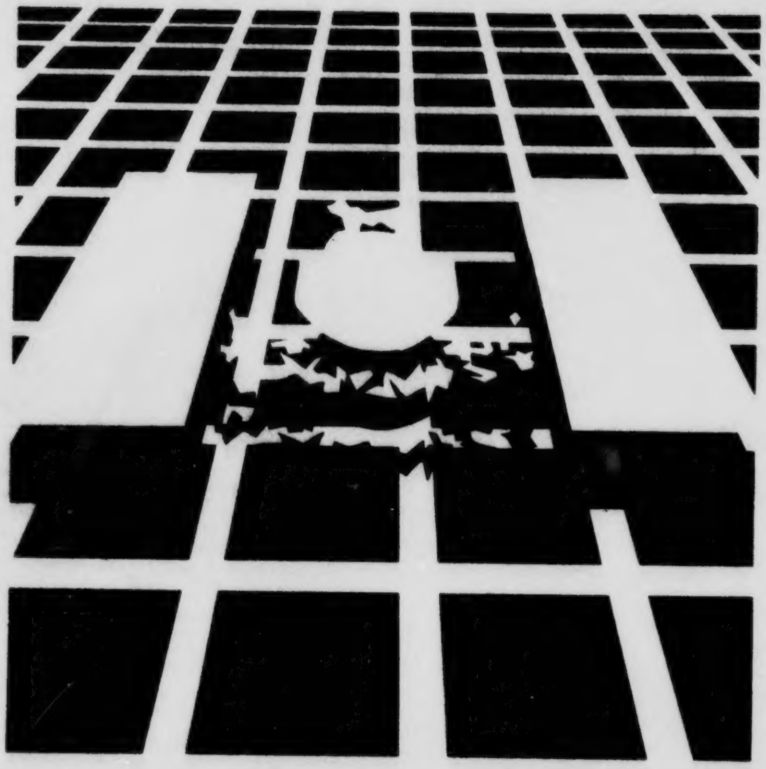
24. What was the sum of all government transfer payments received by your Yukon operation during the year? $ ______

Volume

2

INPUT - OUTPUT TABLE FOR YUKON

Vol. 2



YUKON RIVER BASIN STUDY

This project was completed for the Yukon River Basin Study, an intergovernmental study funded by the governments of Canada, Yukon and British Columbia.

YUKON INPUT-OUTPUT

COMPUTER PROGRAMS

VOLUME II

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HOW TO USE THE YUKON INPUT-OUTPUT PROGRAMS OVERVIEW

This overview is a description in prose of the computer files that comprise the Yukon input-output model and their inter-relationships. The following sections include the technical details pertinent to user operation.

The main program, IMPACN.FOR, utilizes a set of default values for final demand, the matrix of direct plus indirect coefficients, and user input to produce a complete transactions table. IMPACN.FOR is an interactive program. That is, during the process of running the program the user is prompted to make desired changes in any one or more of the five final demand categories. At the beginning of each run the original or default, final demand values (1978) are read from YUKON.DAT together with the direct plus indirect coefficient matrices (from INV.OUT). The matrix of direct plus indirect coefficients is used to calculate inter-industry transactions required to support any specified level of final demand. In addition to providing information for final demand values, the original transactions table in YUKON.DAT is also used to calculate the proportions of factor payments to gross outlays. These proportions are then applied to any (new) level of gross outlays or gross output to generate new values for factor payments rows. If the user makes no changes during the process of running IMPACN.FOR, the original transactions table will be reproduced. If changes are made to the default final demand values, a new transactions table reflecting these changes will be produced, allowing the user to view the effects of changes in final demand on all sectors represented in the model including factor incomes. The usual linearity assumptions associated with input-output models apply. Changes made during a terminal session do not affect the default data set, YUKON.DAT.

The new (or unchanged) transactions table may be printed either on a computer file or at a line printer as is convenient at the user's installation. The program is currently set up to store the output (transactions table) on a computer disk file, CHECK.DAT, which can then be viewed or dumped for hard copy output. In addition selected portions of the transactions table are printed on another file, IMPACT.OUT, during each run of IMPACN.FOR. IMPACT.OUT is used by a program, PHYSIN.FOR, that calculates physical input requirements corresponding to the levels of output represented by IMPACT.OUT.

Running the program PHYSIN.FOR (physical input requirements program) involves inputs from two other very small data sets, PHYSIN.IN1 and PHYSIN.IN2. The former contains data on specified input requirements by industries 1 to 13 in a base year. For example, the input currently contained in and listed on the first line of PHYSIN.IN1 is "ELECTRICAL". On the second line of the data set the units are defined as KWH. Following this are the (fictitous) KWH of electricity used by each of the 13 industries in the base year 1978. Any physical input may be specified in this data set. The "base" year is defined by the year for which gross outlays of each industry are represented in the data set PHYSIN.IN2. This data set contains simply the value of gross outlays for each of industries 1 to 13. The ratios of physical input requirements (PHYSIN.IN1) to gross outlays (PHYSIN.IN2) in the base year are used to project physical input requirements corresponding to any level of gross outlays (from IMPACT.OUT) resulting from user specified final demand values. PHYSIN.FOR is not an interactive program and must be run separately after IMPACN.FOR is run if physical input requirements implied by changes introduced during a run of IMPACN.FOR are to be calculated. The output of PHYSIN.FOR is printed on a computer file, PHYSIN.OUT, but could, of course, be printed at a line printer if desired. Output shows final demand values for each of five sectors and 13 industries, gross output of each industry and physical input requirements by each industry.

The main function of the input-output programs is represented by the two programs discussed above, IMPACN.FOR and PHYSIN.FOR, together with their input and output files. However, copies of intermediate programs utilized to produce input files for IMPACN.FOR and to summarize information on multipliers have also been included. These programs may never be used but if the basic 1978 transactions table were to be changed, the user could duplicate the intermediate steps necessary to operate IMPACN.FOR.

As mentioned above, the initial transactions table, contained in YUKON.DAT, is only one of the inputs to IMPACN.FOR. The other is INV.OUT, the matrix of direct plus indirect coefficients. The latter is calculated by a program, INV.FOR, which inverts a matrix that is the identity matrix minus the direct coefficients matrix. The matrix of direct coefficients is read in INV.FOR from a file COEFF.DAT. COEFF.DAT contains the coefficients that were computed as the ratios of each cell in the inter-industry portion of the transactions table to gross outlays of the purchasing industry. That is, each entry in the inter-industry portion of the table is divided by the sum of the column in which it appears. The result is known as a direct requirements matrix. In addition to the 13 by 13 direct requirements matrix, coefficients for the household column (consumption) and household row (labour income) were included in order to permit the option of "closing" the system with respect to households. The closed system treats households as an industry instead of an exogenous final demand sector. The COEFF.DAT data set then, contains direct coefficients for the inter-industry table, for the household column (HC) and the household row (HR). In the event that the initial transactions table were to be changed, values in COEFF.DAT would also need to be manually changed.

The program INV.FOR inverts the (identity matrix minus the direct requirements matrix) for both the open and closed systems to produce direct plus indirect requirements matrices. The output of INV.FOR is INV.OUT in which the direct requirements matrix from COEFF.DAT is duplicated followed by the direct plus indirect coefficients for the open and the closed systems. These coefficients show not only the direct purchases that industry X makes from itself and other industry sectors to achieve a $1 increase in total output, but also the further indirect effects that this $1 increase causes as a result of X's suppliers having to make additional purchases of inputs to expand their output.

In addition to their primary function as inputs to IMPACN.FOR, the direct plus indirect coefficients can also be used to compute summary measures of the degree of interdependence in the economy called multipliers. The program called MULT.FOR reads inputs from INV.OUT and computes Type I and

Type II multipliers. The Type I multiplier shows, for each sector, the direct plus indirect changes in income resulting from an increase of $1 in the output of all the processing sectors. The Type II multiplier shows direct plus indirect effects plus induced changes in income resulting from $1 increase in final demand. These income multipliers as well as other associated information are printed on an output file MULT.OUT.

The above discussion and the following "Detail" refers to computer data set names for the Yukon but applies equally to the Yukon River Basin (YRB) data sets. Only two data sets have different names for the YRB than the Yukon these are YRB.COE (=COEFF.DAT) and YRB.DAT (=YUKON.DAT). All other data sets have identical names and serve identical functions.

DETAIL

The following shows, for each program, the units from which input is read or to which output is routed. Actual JCL statements will be peculiar to the installation where the programs are used. Information required to make the two computer installations compatible has been sent separately. Finally a flow chart shows the relationships of the data sets to one another.

I. INV.FOR

A. Input Data

1. It reads its input data from COEFF.DAT which is set up in the following format:

   a. the direct requirements matrix where each row is:

      (3X, 8F9.6/3X, 5F9.6)

   b. the household coefficient column (consumption divided by total outlay on consumption):

      (3X, 8F9.6/3X, 6F9.6)

   c. the household coefficient row ((labour income of an industry divided by total labour income paid by all industries multiplied by total outlay on consumption) divided by total outlay of that industry):

      (3X, 8F9.6/3X, 6F9.6)

B. Output Data

1. Output is:

   a. direct requirements matrix

   b. household coefficient row

   c. household coefficient column

   d. the inverse of the identity matrix minus the direct requirements matrix

   e. the inverse of the identity matrix minus the direct requirements matrix including the household row and column

2. Output data is written on INV.OUT.

C. Other Information

1. INV.FOR is a utility program. It is available to the users but it does not have the frills of the other programs.

2. INV.FOR requires the COEFF.DAT file.

II. MULT.FOR

A. Input Data

1. MULT.FOR receives its input data from INV.FOR through the file INV.OUT.

B. Output Data

1. MULT.FOR prints a table of multipliers on MULT.OUT.

C. Other Information

1. MULT.FOR requires that INV.FOR has been run previously to produce the INV.OUT files.

III. IMPACN.FOR

A. Input Data

1. IMPACN.FOR reads the output of INV.FOR via the file INV.OUT.

2. IMPACN.FOR also reads YUKON.DAT which is set up in the following format:

   a. transactions table:
   (3X, 8F9.0/3X, 8F9.0/3X, 6F9.0)

   b. final demands:
   (3X, 5F9.0)

   c. residual labour income (labour income of an industry less (the household coefficient row element for that industry multiplied by total outlay by that industry)):
   (3X, 8F9.0/3X, 5F9.0)

3. IMPACN.FOR modifies final demand according to terminal inputs made by the user while the program is executing. Instructions to the user appear at the terminal during execution.

B. Output Data

1. New final demand and new gross output are printed on IMPACT.OUT for use by PHYSIN.FOR.

2. The new transactions table is printed on output file CHECK.DAT.

C. Other Information

1. IMPACN.FOR requires that INV.FOR has been run previously.

IV. PHYSIN.FOR

A. Input Data

1. The user must set up the file PHYSIN.IN1 in the following format:

   a. title of physical input requirement:
   (A10)

   b. units of measurement of physical input requirement:
   (A3)

   c. base year physical input requirements
   (3X, 8F9.0/3X, 5F9.0)

2. PHYSIN.IN2 is set up by the programmer in the following format:

   a. base year gross output by industry:
   (3X, 8F9.0/3X, 5F9.0)

3. PHYSIN.FOR also reads the output of IMPACN.FOR from IMPACT.OUT.

B. Output Data

1. PHYSIN.FOR prints a table relating new final demand and gross output to new physical input requirements at the line printer.

C. Other Information

1. PHYSIN.FOR is closely linked to IMPACN.FOR in that it calculates the implication of the most recently calculated scenario. Not only is it important that IMPACN.FOR have been run previously but it is important that the most recent run be the one to be analyzed. The user should take care to check the final demands each time to be sure there has been no confusion.

JCL for Yukon Input-Output Programs

I. INV.FOR

READ:

on Unit 8, disk file COEFF.DAT

WRITE:

on unit 10, disk file INV.OUT

II. MULT.FOR

READ:

on unit 8, disk file INV.OUT

WRITE:

on unit 10, disk file MULT.OUT

III. IMPACN.FOR

READ:

on unit 5 from the terminal
on unit 8 from disk file YUKON.DAT
on unit 9 from disk file INV.OUT

WRITE:

on unit 10, on disk file IMPACT.OUT
on unit 12, on disk file CHECK.DAT

V. PHYSIN.OUT

READ:

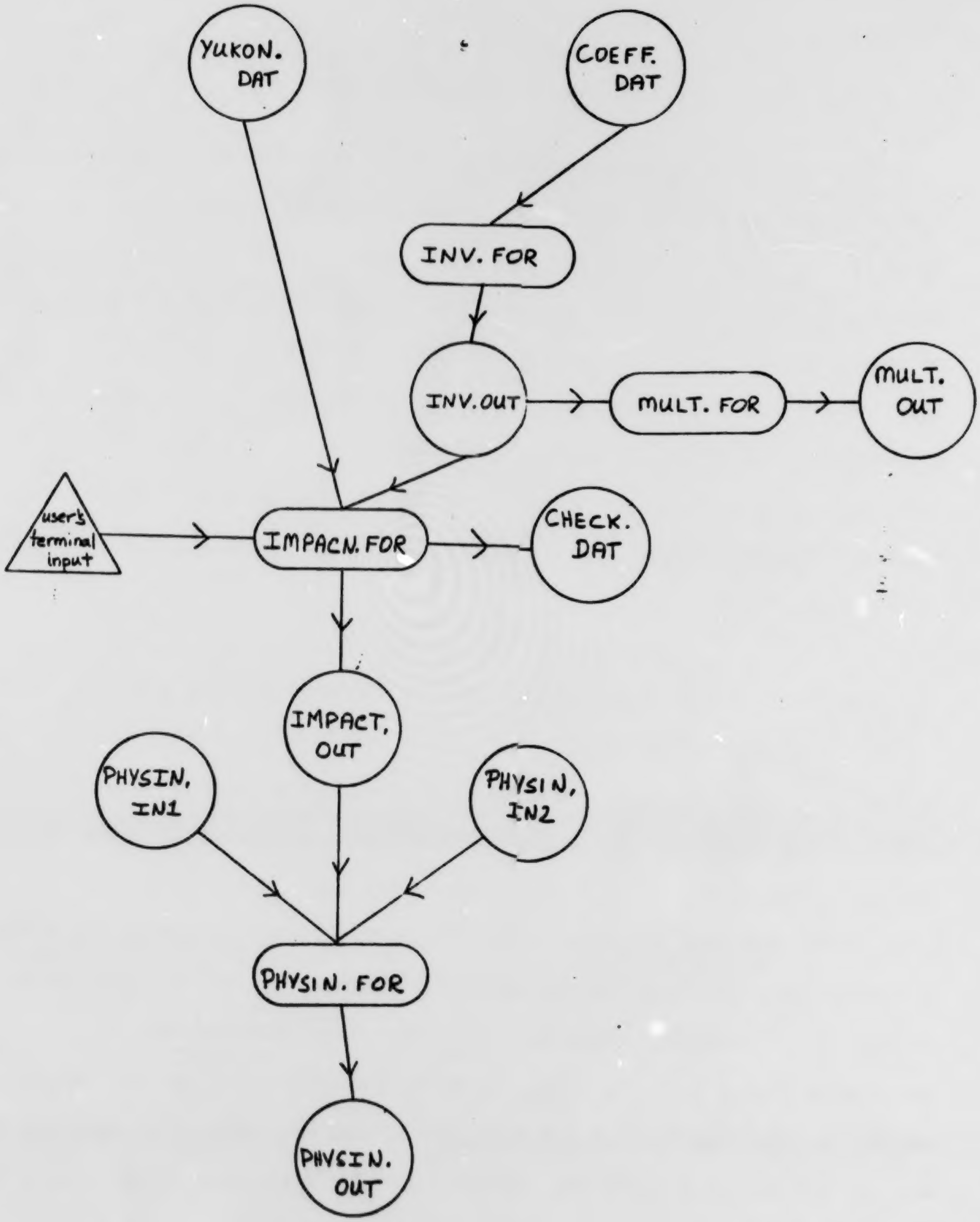
on unit 8 from disk file PHYSIN.IN1
on unit 9 from disk file PHYSIN.IN2
on unit 11 from disk file IMPACT.OUT

WRITE:

on unit 10, disk file PHYSIN.OUT

FLOW CHART

The following is a flow chart showing inter-relationships among data sets. The names refer to those for the Yukon; corresponding YRB data sets are discussed above in the section "... Overview".


YUKON. DAT
COEFF. DAT
INV. FOR
INV.OUT
MULT. FOR
MULT. OUT
user's terminal input
IMPACN. FOR
CHECK. DAT
IMPACT, OUT
PHYSIN, IN1
PHYSIN, IN2
PHYSIN. FOR
PHYSIN. OUT

SAMPLE TERMINAL SESSIONS

Three sample terminal sessions have been produced to illustrate how IMPACN.FOR is used. An arrow → in the margin marks those lines that are typed by the user. These are numbered sequentially through all three terminal sessions to facilitate reference to them. All other statements are generated by IMPACN.FOR. The three terminal sessions are numbered I, II and III. While an attempt has been made to anticipate the types of questions or problems that may arise, it is unlikely that all possible occurrences have been anticipated. However, the program has been able to accommodate all errors or requests during its testing and operation. Each terminal session is discussed below.

The very first statement, 1, typed by the user will be specific to the installation. Only "RUN IMPACN" was typed. The first character is a prompt symbol generated by the computer. Initiating the running of the program automatically results in the statemnts that follow statement 1. Final demand sectors, labelled A to E, and industries, numbered 1 to 13, are listed as a handy reference for the user. The user is then asked whether he/she wishes to see the default final demand values, followed by a carriage return. Default final demand values are those read from YUKON.DAT (or YRB.DAT). A response of Y or N is required. Anything else, including no response, results in "RESPONSE INVALID - PLEASE RE-TYPE" as seen following responses 23 and 25 in Terminal Sessions II and III. The Y response of #2 results in final demand values from YUKON.DAT being printed. A response of N as in #19 results in the immediate printing of the next question "DO YOU WISH TO CHANGE ANY OF THE DEFAULT VALUES OF FINAL DEMAND?" If the response is Y, #3, the next question is "WHICH CATEGORY"? If the response is N, #26, the next question is "DO YOU WISH TO SEE THE NEW FINAL DEMAND VALUES?" even if no changes have been made. A "Y" response at this point would then result in the default values being printed. If a change in final demand is desired one of the categories A through E must be indicated as in #4. The computer prompt that follows is "TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 13, SEPARATED BY COMMAS". If more than 13 numbers are entered, as in #5 only the first 13 are read, the remainder are ignored. The next question is "DO YOU HAE ANY OTHER CHANGES"? At this point the user may change any category including one to which changes have already been made in the same terminal session. The last set of changes made to any category of final demand are the ones in effect at the time the terminal session ends. Typing final demand values separated by spaces instead of commas as in #8 results in no error. If less than 13 values are typed, the carriage return results in nothing being printed by the computer until a total of 13 values have been entered; see responses 14 and 15.

When all desired changes have been made, the user will have made an N response to either "DO YOU HAVE ANY OTHER CHANGES?", number 16, or "DO YOU WISH TO CHANGE ANY OF THE DEFAULT VALUES OF FINAL DEMAND?", number 20. The user is then asked "DO YOU WISH TO SEE THE NEW FINAL DEMAND VALUES?", again requiring a Y or N response. A Y response results in the complete set, changed and unchanged, of final demand values being printed. These will be the ones that are used in producing the new transactions table. After either the new final demand values have been printed or the user has indicated that he/she does not wish to see these values, number 21, the message "THE TRANSACTIONS TABLE CORRESPONDING TO THESE FINAL DEMAND VALUES WILL NOW BE CALCULATED AND PRINTED AT THE LINE PRINTER" will be printed. This ends the terminal session and the output will be produced either at a printer or on computer disk depending on the JCL that has been utilized.

I.

```
1 →  @RUN IMPACN
     WELCOME TO THE INTERACTIVE FINAL DEMAND MODIFICATION
     ROUTINE OF THE IMPACT CALCULATION PROGRAM.
     FINALD DEMAND CATEGORIES:

          A.  VALUE OF THE PHYSICAL CHANGE IN INVENTORIES

          B.  EXPORTS

          C.  GOVERNMENT

          D.  GROSS FIXED CAPITAL FORMATION

          E.  CONSUMPTION

     INDUSTRY CATEGORIES:

          1.  HARD-ROCK MINING

          2.  PLACER MINING

          3.  OIL AND GASE

          4.  FORESTRY

          5.  FISHING, HUNTING, TRAPPING AND SUBSISTENCE

          6.  TRANSPORTATION

          7.  CONSTRUCTION

          8.  UTILITIES

          9.  WHOLESALE TRADE

         10.  RETAIL TRADE

         11.  SERVICES

         12.  FINANCE, INSURANCE, AND REAL ESTATE

         13.  MANUFACTURING

     DO YOU WISH TO REVIEW THE DEFAULT FINAL DEMAND
```

```
       VALUES FOR EACH INDUSTRY?  (TYPE Y OR N)
2 →    Y
       A. VALUE OF PHYSICAL CHANGE IN INVENTORIES
       1    17378.0
       2        0.0
       3        0.0
       4        0.0
       5        0.0
       6        0.0
       7        0.0
       8        0.0
       9        0.0
       10       0.0
       11       0.0
       12       0.0
       13       0.0
       B.  EXPORTS
       1   133213.0
       2     1247.0
       3       57.0
       4        0.0
       5      934.0
       6        0.0
       7        0.0
       8      724.0
       9        0.0
       10   25687.0
       11   12983.0
       12    1309.0
       13       0.0
       C. GOVERNMENT
       1        0.0
       2        0.0
       3        0.0
       4      119.0
       5        0.0
       6     2580.0
       7     2302.0
       8      238.0
       9    24486.0
       10    7183.0
       11    2143.0
       12       0.0
       13     635.0
       D. GROSS FIXED CAPITAL FORMATION
       1        0.0
       2        0.0
       3        0.0
       4        0.0
       5        0.0
       6        0.0
       7    11398.0
       8        0.0
       9    24961.0
       10       0.0
```

```
            11        0.0
            12        0.0
            13        0.0
            E. CONSUMPTION
            1         0.0
            2         0.0
            3         0.0
            4         0.0
            5      3696.0
            6         0.0
            7         0.0
            8      7187.0
            9         0.0
            10    37571.0
            11    21027.0
            12    11810.0
            13        0.0
            DO YOU WISH TO CHANGE ANY OF THE DEFAULT VALUES
            OF FINAL DEMAND?  (TYPE Y OR N)
   3 →      Y
            WHICH CATEGORY?  (TYPE A, B, C, D, OR E)
   4 →      B
            TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 13,
            SEPARATED BY COMMAS
   5 →      9,9,9,9,9,9,9,9,9,9,9,9,9,9,9,9
            DO YOU HAVE ANY OTHER CHANGES?  (TYPE Y OR N)
   6 →      Y
            WHICH CATEGORY?  (TYPE A, B, C, D, OR E)
   7 →      B
            TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 13,
            SEPARATED BY COMMAS
   8 →      9 9 9 9 9 9 9 9 9 9 9 9 9
            DO YOU HAE ANY OTHER CHANGES?  (TYPE Y OR N)
   9 →      Y
            WHICH CATEGORY?  (TYPE A, B, C, D, OR E)
  10 →      B
            TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 13,
            SEPARATED BY COMMAS
  11 →      9,9,9,9,9,9,9,9,9,9,9,9,9,
            DO YOU HAVE ANY OTHER CHANGES?  (TYPE Y OR N)
  12 →      Y
            WHICH CATEGORE?  (TYPE A, B, C, D, OR E)
  13 →      A
            TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 13,
            SEPARATED BY COMMAS
  14 →      5,5,5,5,5,5,5,5,55,5,5,5,
  15 →      5
            DO YOU HAVE ANY OTHER CHANGES?  (TYPE Y OR N)
  16 →      N
            DO YOU WISH TO SEE THE NEW FINAL DEMAND VALUES?
            (TYPE Y OR N)
  17 →      Y
```

```
A. VALUE OF PHYSICAL CHANGE IN INVENTORIES
1          5.0
2          5.0
3          5.0
4          5.0
5          5.0
6          5.0
7          5.0
8          5.0
9         55.0
10         5.0
11         5.0
12         5.0
13         5.0
B. EXPORTS
1          9.0
2          9.0
3          9.0
4          9.0
5          9.0
6          9.0
7          9.0
8          9.0
9          9.0
10         9.0
11         9.0
12         9.0
13         9.0
C. GOVERNMENT
1          0.0
2          0.0
3          0.0
4        119.0
5          0.0
6       2580.0
7       2302.0
8        238.0
9      24486.0
10      7183.0
11      2143.0
12         0.0
13       635.0
D. GROSS FIXED CAPITAL FORMATION
1          0.0
2          0.0
3          0.0
4          0.0
5          0.0
6          0.0
7      11398.0
8          0.0
9      24961.0
10         0.0
11         0.0
12         0.0
```

```
13        0.0
E. CONSUMPTION
1         0.0
2         0.0
3         0.0
4         0.0
5      3696.0
6         0.0
7         0.0
8      7187.0
9         0.0
10    37571.0
11    21027.0
12    11810.0
13        0.0
THE TRANSACTIONS TABLE CORRESPONDING TO THESE FINAL
DEMAND VALUES WILL NOW BE CALCULATED AND PRINTED AT
THE LINE PRINTER
```

II.

18 →
```
@RUN IMPACN
WELCOME TO THE INTERACTIVE FINAL DEMAND MODIFICATION
ROUTINE OF THE IMPACT CALCULATION PROGRAM.
FINAL DEMAND CATEGORIES:

     A.  VALUE OF THE PHYSICAL CHANGE IN INVENTORIES

     B.  EXPORTS

     C.  GOVERNMENT

     D.  GROSS FIXED CAPITAL FORMATION

     E.  CONSUMPTION

INDUSTRY CATEGORIES:

     1.  HARD-ROCK MINING

     2.  PLACER MINING

     3.  OIL AND GAS

     4.  FORESTRY

     5.  FISHING, HUNTING, TRAPPING AND SUBSISTENCE

     6.  TRANSPORTATION

     7.  CONSTRUCTION
```

```
          8.  UTILITIES

          9.  WHOLESALE TRADE

         10.  RETAIL TRADE

         11.  SERVICES

         12.  FINANCE, INSURANCE, AND REAL ESTATE

         13.  MANUFACTURING

     DO YOU WISH TO REVIEW THE DEFAULT FINAL DEMAND
     VALUES FOR EACH INDUSTRY?  (TYPE Y OR N)
19→  N
     DO YOU WISH TO CHANGE ANY OF THE DEFAULT VALUES
     OF FINAL DEMAND?  (TYPE Y OR N)
20→  N
     DO YOU WISH TO SEE THE NEW FINAL DEMAND VALUS?
     (TYPE Y OR NO
21→  N
     THE TRANSACTIONS TABLE CORRESPONDING TO THESE FINAL
     DEMAND VALUES WILL NOW BE CALCULATED AND PRINTED AT
     THE LINE PRINTER
```

III.

```
22→  @RUN IMPACN
     WELCOME TO THE INTERACTIVE FINAL DEMAND MODIFICATION
     ROUTINE OF THE IMPACT CALCULATION PROGRAM.
     FINAL DEMAND CATEGORIES:

          A.  VALUE OF THE PHYSICAL CHANGE IN INVENTORIES

          B.  EXPORTS

          C.  GOVERNMENT

          D.  GROSS FIXED CAPITAL FORMATION

          E.  CONSUMPTION

     INDUSTRY CATEGORIES:

          1.  HARD-ROCK MINING

          2.  PLACER MINING

          3.  OIL AND GAS

          4.  FORESTRY
          5.  FISHING, HUNTING, TRAPPING AND SUBSISTENCE

          6.  TRANSPORTATION

          7.  CONSTRUCTION

          8.  UTILITIES

          9.  WHOLESALE TRADE

         10.  RETAIL TRADE

         11.  SERVICES

         12.  FINANCE, INSURANCE, AND REAL ESTATE

         13.  MANUFACTURING

      DO YOU WISH TO REVIEW THE DEFAULT FINAL DEMAND
      VALUES FOR EACH INDUSTRY?  (TYPE Y OR N)
23 →  M
      RESPONSE INVALIDE - PLEASE RE-TYPE
24 →  Y
      A. VALUE OF PHYSICAL CHANGE IN INVENTORIES
      1    17378.0
      2        0.0
      3        0.0
      4        0.0
      5        0.0
      6        0.0
      7        0.0
      8        0.0
      9        0.0
      10       0.0
      11       0.0
      12       0.0
      13       0.0
      B. EXPORTS
      1   133213.0
      2     1247.0
      3       57.0
      4        0.0
      5      934.0
      6        0.0
      7        0.0
      8      724.0
      9        0.0
      10   25687.0
      11   12983.0
      12    1309.0
      13       0.0
      C. GOVERNMENT
      1        0.0
      2        0.0
      3        0.0
```

```
         4      119.0
         5        0.0
         6     2580.0
         7     2302.0
         8      238.0
         9    24486.0
         10    7183.0
         11    2143.0
         12       0.0
         13     635.0
         D. GROSS FIXED CAPITAL FORMATION
         1        0.0
         2        0.0
         3        0.0
         4        0.0
         5        0.0
         6        0.0
         7    11398.0
         8        0.0
         9    24961.0
         10       0.0
         11       0.0
         12       0.0
         13       0.0
         E. CONSUMPTION
         1        0.0
         2        0.0
         3        0.0
         4        0.0
         5     3696.0
         6        0.0
         7        0.0
         8     7187.0
         9        0.0
         10   37571.0
         11   21027.0
         12   11810.0
         13       0.0
         DO YOU WISH TO CHANGE ANY OF THE DEFAULT VALUES
         OF FINAL DEMAND?  (TYPE Y OR N)
    25 →
         RESPONSE INVALID - PLEASE RE-TYPE
    26 → N
         DO YOU WISH TO SEE THE NEW FINAL DEMAND VALUES?
         (TYPE Y OR N)
    27 → N
         THE TRANSACTIONS TABLE CORRESPONDING TO THESE FINAL
         DEMAND VALUES WILL NOW BE CALCULATED AND PRINTED AT
         THE LINE PRINTER
```

YUKON

Program: INV.FOR
Input : COEFF.DAT
Output : INV.OUT

INV.FOR

This program calculates the direct plus indirect requirements matrix by inverting a matrix that is the result of subtracting the direct requirements matrix from the identity matrix.

```
C
C     GIVEN A DIRECT REQUIREMENTS MATRIX, THIS PROGRAM CALCULATES THE
C     INVERSE OF THE IDENTITY MATRIX MINUS THE DIRECT REQUIREMENTS
C     MATRIX.  THIS CALCULATION IS PERFORMED BOTH IN AN OPEN SYSTEM
C     AND IN A CLOSED SYSTEM (IN WHICH A ROW AND COLUMN REPRESENTING
C     HOUSEHOLDS ARE INCLUDED IN THE DIRECT REQUIREMENTS MATRIX).
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     A=DIRECT REQUIREMENTS MATRIX BY INDUSTRY AND INDUSTRY
C     AH=DIRECT REQUIREMENTS MATRIX WITH THE HOUSEHOLD ROW AND COLUMN
C        INCLUDED BY INDUSTRY AND INDUSTRY
C     AJI=TEMPORARY STORAGE USED IN THE MATRIX INVERSION ROUTINE
C     HC=HOUSEHOLD COEFFICIENT COLUMN (PERSONAL EXPENDITURE) BY
C        INDUSTRY
C     HR=HOUSEHOLD COEFFICIENT ROW (WAGES, SALARIES AND SUPPLEMENTARY
C        LABOUR INCOME) BY INDUSTRY
C     IAHINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX INCLUDING THE HOUSEHOLD ROW AND COLUMN BY INDUSTRY
C        AND INDUSTRY
C     IAINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX BY INDUSTRY AND INDUSTRY
C     PIVOT=TEMPORARY STORAGE USED IN THE MATRIX INVERSION ROUTINE
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER FOR INDUSTRY; I=1,2,...,NIP1
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;
C        13=MANUFACTURING; 14=HOUSEHOLDS
C     J=COUNTER FOR INDUSTRY; J=1,2,...,NIP1
C     K=COUNTER FOR INDUSTRY; K=1,2,...,NIP1
C     NI=NUMBER OF INDUSTRIES
C     NIP1=NUMBER OF INDUSTRIES PLUS ONE (REPRESENTING HOUSEHOLDS)
C
      REAL*8 A(13,13)
      REAL*8 AH(14,14)
      REAL*8 AJI
      REAL*8 HC(14)
      REAL*8 HR(14)
      REAL*8 IAHINV(14,14)
      REAL*8 IAINV(13,13)
      REAL*8 PIVOT
C
      INTEGER I, J, K, NI, NIP1
C
```

```
      DATA A /169*0D0/
      DATA AH /196*0D0/
      DATA AJI /0D0/
      DATA HC /14*0D0/
      DATA HR /14*0D0/
      DATA IAHINV /196*0D0/
      DATA IAINV /169*0D0/
      DATA PIVOT /0D0/
C
      OPEN(UNIT=8,DEVICE='DSK',FILE='COEFF.DAT')
      OPEN(UNIT=10,DEVICE='DSK',FILE='INV.OUT')
C
C     INPUT ROUTINE
C
      NI=13
      NIP1=NI+1
      DO 1 I=1,NI
1     READ(8,2)(A(I,J),J=1,NI)
2     FORMAT(3X,8F9.6/3X,5F9.6)
      READ(8,3)(HC(I),I=1,NIP1)
3     FORMAT(' HC',8F9.6/3X,6F9.6)
      READ(8,4)(HR(I),I=1,NIP1)
4     FORMAT(' HR',8F9.6/3X,6F9.6)
C
C     CALCULATION OF A, AH, I-A AND I-AH
C
      DO 10 I=1,NI
      DO 10 J=1,NI
10    AH(I,J)=A(I,J)
      DO 11 I=1,NI
11    AH(I,NIP1)=HC(I)
      DO 12 J=1,NIP1
12    AH(NIP1,J)=HR(J)
      DO 13 I=1,NI
13    IAINV(I,I)=1.0-A(I,I)
      DO 14 I=1,NI
      DO 14 J=1,NI
      IF (I.EQ.J) GO TO 14
      IAINV(I,J)=-A(I,J)
14    CONTINUE
      DO 15 I=1,NIP1
15    IAHINV(I,I)=1.0-AH(I,I)
      DO 16 J=1,NIP1
      DO 16 I=1,NIP1
      IF (I.EQ.J) GO TO 16
      IAHINV(I,J)=-AH(I,J)
16    CONTINUE
C
C     CALCULATION OF THE INVERSE OF I-A AND I-AH
C
      DO 20 I=1,NI
      PIVOT=IAINV(I,I)
      IAINV(I,I)=1.0
      DO 21 K=1,NI
21    IAINV(I,K)=IAINV(I,K)/PIVOT
```

```
      DO 22 J=1,NI
      IF (J-I) 23,22,23
23    AJI=IAINV(J,I)
      IAINV(J,I)=0.0
      DO 24 K=1,NI
24    IAINV(J,K)=IAINV(J,K)-IAINV(I,K)*AJI
22    CONTINUE
20    CONTINUE
      DO 30 I=1,NIP1
      PIVOT=IAHINV(I,I)
      IAHINV(I,I)=1.0
      DO 31 K=1,NIP1
31    IAHINV(I,K)=IAHINV(I,K)/PIVOT
      DO 32 J=1,NIP1
```

```
      IF (J-I) 33,32,33
33    AJI=IAHINV(J,I)
      IAHINV(J,I)=0.0
      DO 34 K=1,NIP1
34    IAHINV(J,K)=IAHINV(J,K)-IAHINV(I,K)*AJI
32    CONTINUE
30    CONTINUE
C
C     OUTPUT ROUTINE
C
      DO 40 I=1,NI
40    WRITE(10,41) I,(A(I,J),J=1,NI)
41    FORMAT(I3,8F9.6/3X,5F9.6)
      WRTIE(10,43)(HR(I),I=1,NIP1)
43    FORMAT(' HR',8F9.6/3X,6F9.6)
      WRITE(10,45)(HC(I),I=1,NIP1)
45    FORMAT(' HC',8F9.6/3X,6F9.6)
      DO 46 I=1,NI
46    WRITE(10,41) I,(IAINV(I,J),J=1,NI)
      DO 47 I=1,NIP1
47    WRITE(10,48) I,(IAHINV(I,J),J=1,NIP1)
48    FORMAT(I3,8F9.6/3X,6F9.6)
      STOP
      END
```

COEFF.DAT

This data set consists of the direct requirements matrix derived from the 1978 transactions table. It is the input used by the preceding INV.FOR program.

```
 1 0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
   0.0         0.0         0.0         0.0         0.0
 2 0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
    .01202     0.0         0.0         0.0          .07441
 3 0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
   0.0         0.0         0.0         0.0         0.0
 4  .00113     0.0         0.0         0.0         0.0         0.0          .00223     0.0
   0.0         0.0         0.0         0.0          .13791
 5 0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
    .00000      .00000      .00000      .00000      .00000
 6  .09425      .05394      .10526      .03874     0.0          .02421      .10447      .12591
    .23857      .11929      .02521      .00055      .02457
 7  .00388      .01551      .01754      .06295     0.0          .20255      .23309      .19107
    .18696      .19993      .00616      .06445      .00035
 8  .04766      .00169     0.0          .00242     0.0          .01175      .00759      .03655
    .01040      .01449      .01495      .01983      .02319
 9  .01716      .11362      .03509      .00145     0.0          .04086      .02877      .00971
    .03626      .10203      .02508      .03974      .00770
10  .00037      .00978      .01754     0.0          .22289      .02723      .01417     0.0
    .00113      .00233      .02495      .00263      .04456
11  .06178      .07889     0.0         0.0         0.0          .05633      .03434      .15266
    .01958      .10507      .08087      .00241      .00770
12  .00024      .01281     0.0         0.0         0.0          .05659      .04815      .14337
    .05907      .10762      .10194      .07000      .03539
13  .06244      .00270      .0         0.0         0.0          .00160      .00034      .00864
    .00048      .01358      .00084      .00038      .00424
HC  .00000      .00000      .00000      .00000      .03742      .00000      .00000      .07277
    .00000      .38043      .21291      .11958      .00000      .00000
HR  .15387      .13149     2.42105      .33172      .00000      .14522      .16534      .07199
    .09679      .11206      .21086      .04691      .07198      .00000
```

INV.OUT

The first part of this data set is a duplicate of the direct requirements matrix COEFF.DAT. Following this are the direct plus indirect requirements matrices for both the closed economy and the open economy. The closed system is distinguished from the open system in that the household sector (Consumption column and Labour Income Row) becomes part of the Inter-industry matrix.

```
  1 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000
  2 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.012020 0.000000 0.000000 0.000000 0.074410
  3 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000
  4 0.001130 0.000000 0.000000 0.000000 0.000000 0.000000 0.002230 0.000000
    0.000000 0.000000 0.000000 0.000000 0.137910
  5 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000
  6 0.094250 0.053940 0.105260 0.038740 0.000000 0.024210 0.104470 0.125910
    0.238570 0.119290 0.025210 0.000550 0.024570
  7 0.003880 0.015510 0.017540 0.062950 0.000000 0.202550 0.233090 0.191070
    0.186960 0.199930 0.006160 0.064450 0.000350
  8 0.047660 0.001690 0.000000 0.002420 0.000000 0.011750 0.007590 0.036550
    0.010400 0.014490 0.014950 0.019830 0.023190
  9 0.017160 0.113620 0.035090 0.001450 0.000000 0.040860 0.028770 0.009710
    0.036260 0.102030 0.025080 0.039740 0.007700
 10 0.000370 0.009780 0.017540 0.000000 0.222890 0.027230 0.014170 0.000000
    0.001130 0.002330 0.024950 0.002630 0.044560
 11 0.061780 0.078890 0.000000 0.000000 0.000000 0.056330 0.034340 0.152660
    0.019580 0.105070 0.060870 0.002410 0.007700
 12 0.000240 0.012810 0.000000 0.000000 0.000000 0.056590 0.048150 0.143370
    0.059070 0.107620 0.101940 0.070000 0.035390
 13 0.062440 0.002700 0.000000 0.000000 0.000000 0.001600 0.000340 0.008640
    0.000480 0.013580 0.000840 0.000380 0.004240
 HR 0.153870 0.131490 2.421050 0.331720 0.000000 0.145220 0.165340 0.071990
    0.096790 0.112660 0.210860 0.046910 0.071980 0.000000
 HC 0.000000 0.000000 0.000000 0.000000 0.037420 0.000000 0.000000 0.072770
    0.000000 0.380430 0.212910 0.119560 0.000000 0.000000
  1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000
  2 0.005117 1.001835 0.000625 0.000111 0.000622 0.001002 0.000793 0.001294
    0.013006 0.002791 0.000629 0.000679 0.075189
  3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000
  4 0.010059 0.000669 0.000261 1.000256 0.000645 0.001101 0.003274 0.002163
    0.001043 0.002895 0.000364 0.000384 0.138815
  5 0.000000 0.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000
  6 0.124485 0.103195 0.131732 0.053655 0.046284 1.085866 0.169616 0.191875
    0.308248 0.207654 0.051515 0.030405 0.059619
  7 0.066763 0.090920 0.078109 0.101118 0.084339 0.327445 1.383050 0.348295
    0.303266 0.376388 0.057491 0.120234 0.061935
  8 0.055686 0.006054 0.003752 0.004457 0.006417 0.020688 0.017139 1.051670
    0.021904 0.026789 0.021934 0.024710 0.028733
  9 0.031606 0.131717 0.048085 0.007863 0.031221 0.066684 0.057445 0.045422
    1.071579 0.140073 0.041712 0.051295 0.030355
 10 0.009977 0.016904 0.022811 0.003159 0.227014 0.036976 0.026406 0.016353
    0.016858 1.016503 0.030264 0.005900 0.049155
 11 0.069467 0.101939 0.015358 0.008375 0.033856 0.088249 0.069496 0.203053
    0.062296 0.151897 1.101708 0.015158 0.032045
 12 0.035336 0.047653 0.020048 0.010980 0.040271 0.104521 0.098955 0.219270
    0.118027 0.180677 0.136479 1.092797 0.061694
 13 0.063066 0.003381 0.000627 0.000218 0.003315 0.002690 0.001380 0.010056
    0.001689 0.014875 0.001709 0.000841 1.005564
  1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
  2 0.005495 1.002180 0.004648 0.000728 0.000724 0.001427 0.001279 0.001675
    0.013405 0.003246 0.001083 0.000827 0.075476 0.001713

  3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
    0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
  4 0.010440 0.001017 0.004521 1.000878 0.000748 0.001530 0.003765 0.002547
    0.001445 0.003355 0.000822 0.000534 0.139105 0.001729
  5 0.010131 0.009252 0.113364 0.016559 1.002727 0.011412 0.013045 0.010215
    0.010710 0.012233 0.012189 0.003975 0.007699 0.045990
  6 0.154077 0.130219 0.462646 0.102022 0.054248 1.119198 0.207720 0.221711
    0.339528 0.243384 0.067118 0.042016 0.082107 0.134327
  7 0.120660 0.140140 0.681191 0.189211 0.098844 0.386155 1.452450 0.402637
    0.420240 0.443466 0.122337 0.141383 0.102894 0.244660
  8 0.081500 0.031629 0.292607 0.046651 0.013364 0.049766 0.050380 1.077698
    0.049192 0.059960 0.052993 0.034840 0.048351 0.117184
  9 0.051310 0.149711 0.268562 0.040069 0.036524 0.088878 0.082817 0.065288
    1.092406 0.163864 0.065419 0.059027 0.045329 0.089443
 10 0.119440 0.116869 1.247649 0.182073 0.256474 0.160276 0.167356 0.126720
    0.132571 1.150674 0.161965 0.048851 0.132340 0.496895
 11 0.173454 0.176638 0.955130 0.145649 0.056460 0.182852 0.177641 0.287734
    0.151078 0.253307 1.202757 0.048113 0.095870 0.381249
 12 0.101971 0.108460 0.765103 0.119812 0.058191 0.179522 0.184693 0.286405
    0.168413 0.261076 0.716591 1.118924 0.112294 0.302256
 13 0.005556 0.005107 0.021771 0.003306 0.003824 0.004818 0.003813 0.011961
    0.003686 0.017157 0.003982 0.001583 1.007000 0.008577
 14 0.270745 0.247257 3.029506 0.442526 0.072866 0.304969 0.348623 0.272981
    0.286202 0.326913 0.325748 0.106236 0.205748 1.229018
```

YUKON

Program: MULT.FOR
Input: INV.OUT
Output: MULT.OUT

MULT.FOR

This program calculates Type I and Type II multipliers from the direct plus indirect requirements matrices.

```
C
C     GIVEN A DIRECT REQUIREMENTS MATRIX, THIS PROGRAM CALCULATES BOTH
C     TYPE I AND TYPE II MULTIPLIERS FOR EACH INDUSTRY.
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     A=DIRECT REQUIREMENTS MATRIX BY INDUSTRY AND INDUSTRY
C     AH=DIRECT REQUIREMENTS MATRIX WITH HOUSEHOLD ROW AND COLUMN
C        INCLUDED BY INDUSTRY AND INDUSTRY
C     DCHG=DIRECT INCOME CHANGE BY INDUSTRY
C     DICHG=DIRECT AND INDIRECT INCOME CHANGE BY INDUSTRY
C     DIICHG=DIRECT, INDIRECT AND INDUCED INCOME CHANGE BY INDUSTRY
C     HC=HOUSEHOLD COEFFICIENTS COLUMN (PERSONAL EXPENDITURE) BY
C        INDUSTRY
C     HR=HOUSEHOLD COEFFICIENTS ROW (WAGES, SALARIES AND SUPPLEMENTARY
C        LABOUR INCOME) BY INDUSTRY
C     IAHINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX INCLUDING THE HOUSEHOLD ROW AND COLUMN BY INDUSTRY AND
C        INDUSTRY
C     IAINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX BY INDUSTRY AND INDUSTRY
C     ICCHG=INDUCED INCOME CHANGE BY INDUSTRY
C     IICHG=INDIRECT AND INDUCED INCOME CHANGE BY INDUSTRY
C     IRCHG=INDIRECT INCOME CHANGE BY INDUSTRY
C     MULTI=TYPE I MULTIPLIER BY INDUSTRY
C     MULTII=TYPE II MULTIPLIER BY INDUSTRY
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER FOR INDUSTRY; I=1,2,...,NIP1
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;
C        13=MANUFACTURING; 14=HOUSEHOLDS
C     J=COUNTER FOR INDUSTRY; J=1,2,...,NIP1
C     NI=NUMBER OF INDUSTRIES
C     NIP1=NUMBER OF INDUSTRIES PLUS ONE (REPRESENTING HOUSEHOLDS)
C
      REAL*8 A(13,13)
      REAL*8 AH(14,14)
      REAL*8 DCHG(13)
      REAL*8 DICHG(13)
      REAL*8 DIICHG(13)
      REAL*8 HC(14)
      REAL*8 HR(14)
      REAL*8 IAHINV(14,14)
      REAL*8 IAINV(13,13)
      REAL*8 ICCHG(13)
      REAL*8 IICHG(13)
      REAL*8 IRCHG(13)
      REAL*8 MULTI(13)
      REAL*8 MULTII(13)
```

```
C
      INTEGER I, J, N1, N1P1
C
      DATA A /169*0D0/
      DATA AH /196*0D0/
      DATA DCHG /13*0D0/
      DATA DICHG /13*0D0/
      DATA DIICHG /13*0D0/
      DATA HC /14*0D0/
      DATA HR /14*0D0/
      DATA IAHINV /196*0D0/
      DATA IAINV /169*0D0/
      DATA ICCHG /13*0D0/
      DATA IICHG /13*0D0/
      DATA IRCHG /13*0D0/
      DATA MULTI /13*0D0/
      DATA MULTII /13*0D0/
C
      OPEN(UNIT=8,DEVICE='DSK',FILE='INV.OUT')
      OPEN(UNIT=10,DEVICE='DSK',FILE='MULI.OUT')
C
C     INPUT ROUTINE
C
      N1=13
      N1P1=N1+1
      DO 1 I=1,N1
1     READ(8,2)(A(I,J),J=1,N1)
2     FORMAT(3X,8F9.6/3X,5F9.6)
      READ(8,3)(HR(I),I=1,N1P1)
3     FORMAT(3X,8F9.6/3X,6F9.6)
      READ(8,3)(HC(I),I=1,N1P1)
      DO 4 I=1,N1
4     READ(8,2)(IAINV(I,J),J=1,N1)
      DO 5 I=1,N1P1
5     READ(8,3)(IAHINV(I,J),J=1,N1P1)
C
C     CALCULAITON OF AH, DCHG, DICHG, IRCHG AND MULTI
C
      DO 10 I=1,N1
      DO 10 J=1,N1
10    AH(I,J)=A(I,J)
      DO 11 I=1,N1
11    AH(I,N1P1)=HC(I)
      DO 12 J=1,N1P1
12    AH(N1P1,J)=HR(J)
      DO 13 J=1,N1
13    DCHG(J)=AH(N1P1,J)
      DO 14 I=1,N1
      DO 14 J=1,N1
14    DICHG(J)=DICHG(J)+IAINV(I,J)*AH(N1P1,I)
      DO 15 J=1,N1
15    IRCHG(J)=DICHG(J)-DCHG(J)
      DO 16 J=1,N1
16    MULTI(J)=DICHG(J)/DCHG(J)
C
```

```
C       CALCULATION OF DIICHG, ICCHG, IICHG AND MULTII
C
        DO 20 J=1,N1
20      DIICHG(J)=TAHINV(NIP1,J)
        DO 21 J=1,N1
21      ICCHG(J)=DIICHG(J)-DICHG(J)
        DO 22 J=1,N1
22      IICHG(J)=IRCHG(J)+ICCHG(J)
        DO 23 J=1,N1
23      MULTII(J)=DIICHG(J)/DCHG(J)
C
C       OUTPUT ROUTINE
C
        WRITE(10,74)
74      FORMAT('1',53X,'INCOME MULTIPLIERS')
        WRITE(10,50)
50      FORMAT('0',79X,'DIRECT,')
        WRITE(10,51)
51      FORMAT(' ',42X,'DIRECT AND',25X,'INDIRECT AND',12X,
       1 'INDIRECT AND')
        WRITE(10,52)
52      FORMAT(' ',32X,'DIRECT',5X,'INDIRECT',4X,'INDIRECT',16X,'INDUCED',
       1 5X,'INDUCED',5X,'INDUCED')
        WRITE(10,53)
53      FORMAT(' ',32X,3('INCOME',6X),'TYPE I',3(6X,'INCOME'),5X,
       1 'TYPE II')
        WRITE(10,54)
54      FORMAT(' INDUSTRY',18X,3(6X,'CHANGE'),4X,'MULTIPLIER',4X,'CHANGE',
       1 2(6X,'CHANGE'),4X,'MULTIPLIER'/)
        WRITE(10,60) DCHG(1), DICHG(1), IRCHG(1), MULTI(1), DIICHG(1),
       1 ICCHG(1), IICHG(1), MULTII(1)
60      FORMAT('-HARD-ROCK MINING',9X,8F12.2)
        WRITE(10,61) DCHG(2), DICHG(2), IRCHG(2), MULTI(2), DIICHG(2),
       1 ICCHG(2), IICHG(2), MULTII(2)
61      FORMAT('-PLACER MINING',12X,8F12.2)
        WRITE(10,63) DCHG(4), DICHG(4), IRCHG(4), MULTI(4), DIICHG(4),
       1 ICCHG(4), IICHG(4), MULTII(4)
        WRITE(10,62) DCHG(3),DICHG(3),IRCHG(3),MULTI(3),DIICHG(3),
       1ICCHG(3),IICHG(3),MULTII(3)
     62 FORMAT('-OIL AND GAS',14X,8F12.2)
63      FORMAT('-FORESTRY',17X,8F12.2)
        WRITE(10,66) DCHG(6), DICHG(6), IRCHG(6), MULTI(6), DIICHG(6),
       1 ICCHG(6), IICHG(6), MULTII(6)
66      FORMAT('-TRANSPORTATION',11X,8F12.2)
        WRITE(10,67) DCHG(7), DICHG(7), IRCHG(7), MULTI(7), DIICHG(7),
       1 ICCHG(7), IICHG(7), MULTII(7)
67      FORMAT('-CONSTRUCTION',13X,8F12.2)
        WRITE(10,68) DCHG(8), DICHG(8), IRCHG(8), MULTI(8), DIICHG(8),
       1 ICCHG(8), IICHG(8), MULTII(8)
68      FORMAT('-UTILITIES',16X,8F12.2)
        WRITE(10,69) DCHG(9), DICHG(9), IRCHG(9), MULTI(9), DIICHG(9),
       1 ICCHG(9), IICHG(9), MULTII(9)
69      FORMAT('-WHOLESALE TRADE',10X,8F12.2)
        WRITE(10,70) DCHG(10), DICHG(10), IRCHG(10), MULTI(10),
       1 DIICHG(10), ICCHG(10), IICHG(10), MULTII(10)
70      FORMAT('-RETAIL TRADE',13X,8F12.2)
        WRITE(10,72) DCHG(11), DICHG(11), IRCHG(11), MULTI(11),
       1 DIICHG(11), ICCHG(11), IICHG(11), MULTII(11)
```

```
72    FORMAT('-SERVICES',17X,8F12.2)
      WRITE(10,71)
71    FORMAT('0FINANCE, INSURANCE')
      WRITE(10,73) DCHG(12), DICHG(12), IRCHG(12), MULTI(12),
     1 DTICHG(12), ICCHG(12), IICHG(12), MULTII(12)
73    FORMAT(' AND REAL ESTATE',10X,8F12.2)
      WRITE(10,76) DCHG(13), DICHG(13), IRCHG(13), MULTI(13),
     1 DTICHG(13), ICCHG(13), IICHG(13), MULTII(13)
76    FORMAT('-MANUFACTURING',12X,8F12.2)
      WRITE(10,75)
75    FORMAT('1')




      STOP
      END
```

INV.OUT

The direct plus indirect requirements matrices appear on the following pages for both the closed economy and open economy. The closed system is distinguished from the open system in that the household sector (Consumption Column and Labour Income Row) becomes part of the inter-industry matrix.

```
 1 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.012020 0.000000 0.000000 0.000000 0.074410
 3 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001130 0.000000 0.000000 0.000000 0.000000 0.000000 0.002230 0.000000
   0.000000 0.000000 0.000000 0.000000 0.137910
 5 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.094250 0.053940 0.105260 0.038740 0.000000 0.024210 0.104470 0.125910
   0.238570 0.119290 0.025210 0.000550 0.024570
 7 0.003880 0.015510 0.017540 0.062950 0.000000 0.202550 0.233090 0.191070
   0.186960 0.199930 0.006160 0.064450 0.000350
 8 0.047660 0.001690 0.000000 0.002420 0.000000 0.011750 0.007590 0.036550
   0.010400 0.014490 0.014950 0.019830 0.023190
 9 0.017160 0.113620 0.035090 0.001450 0.000000 0.040860 0.028770 0.009710
   0.036260 0.102030 0.025080 0.039740 0.007700
10 0.000370 0.009780 0.017540 0.000000 0.222890 0.027230 0.014170 0.000000
   0.001130 0.002330 0.024950 0.002630 0.044560
11 0.061780 0.078890 0.000000 0.000000 0.000000 0.056330 0.034340 0.152660
   0.019580 0.105070 0.080870 0.002410 0.007700
12 0.000240 0.012810 0.000000 0.000000 0.000000 0.056590 0.048150 0.143370
   0.059070 0.107620 0.101940 0.070000 0.035390
13 0.062440 0.002700 0.000000 0.000000 0.000000 0.001600 0.000340 0.008640
   0.000480 0.013580 0.000840 0.000380 0.004240
HR 0.153870 0.131490 2.421050 0.331720 0.000000 0.145220 0.165340 0.071990
   0.096790 0.112660 0.210860 0.046910 0.071980 0.000000
HC 0.000000 0.000000 0.000000 0.000000 0.037420 0.000000 0.000000 0.072770
   0.000000 0.380430 0.212910 0.119580 0.000000 0.000000
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.005117 1.001835 0.000625 0.000111 0.000622 0.001002 0.000793 0.001294
   0.013006 0.002791 0.000629 0.000679 0.075189
 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.010059 0.000669 0.000261 1.000256 0.000645 0.001101 0.003274 0.002163
   0.001043 0.002895 0.000364 0.000384 0.138815
 5 0.000000 0.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.124485 0.103195 0.131732 0.053655 0.046284 1.085866 0.169616 0.191875
   0.308248 0.207654 0.051515 0.030405 0.059619
 7 0.066763 0.090920 0.078109 0.101118 0.084339 0.327445 1.383050 0.348295
   0.363266 0.378388 0.057491 0.120234 0.061935
 8 0.055686 0.006054 0.003752 0.004457 0.006417 0.020688 0.017139 1.051670
   0.021904 0.028789 0.021934 0.024710 0.028733
 9 0.031606 0.131717 0.048085 0.007863 0.031221 0.066684 0.057445 0.045422
   1.071579 0.140073 0.041712 0.051295 0.030355
10 0.009977 0.016904 0.022811 0.003159 0.227014 0.036976 0.026406 0.016353
   0.016858 1.016503 0.030264 0.005900 0.049155
11 0.089467 0.101939 0.015358 0.008375 0.033856 0.088249 0.069496 0.203053
   0.062296 0.151897 1.101708 0.015158 0.032045
12 0.035336 0.047653 0.020048 0.010980 0.040271 0.104521 0.098955 0.219270
   0.118027 0.180677 0.136479 1.092797 0.061694
13 0.063060 0.003381 0.000627 0.000218 0.003315 0.002690 0.001380 0.010056
   0.001689 0.014875 0.001709 0.000841 1.005564
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.005495 1.002180 0.004848 0.000728 0.000724 0.001427 0.001279 0.001675
   0.013405 0.003246 0.001083 0.000827 0.075476 0.001713



 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.010440 0.001017 0.004521 1.000878 0.000748 0.001530 0.003765 0.002547
   0.001445 0.003355 0.000822 0.000534 0.139105 0.001729
 5 0.010131 0.009252 0.113364 0.016559 1.002727 0.011412 0.013045 0.010215
   0.010710 0.012233 0.012189 0.003975 0.007699 0.045990
 6 0.154077 0.130219 0.462846 0.102022 0.054248 1.119198 0.207720 0.221711
   0.339528 0.243384 0.087118 0.042016 0.062107 0.134327
 7 0.120660 0.140140 0.681191 0.189211 0.098844 0.388155 1.452450 0.402637
   0.420240 0.443406 0.122337 0.141383 0.102894 0.244660
 8 0.081500 0.031629 0.292607 0.046651 0.013364 0.049766 0.050380 1.077698
   0.049192 0.059960 0.052993 0.034840 0.048351 0.117184
 9 0.051310 0.149711 0.268562 0.040069 0.036524 0.088878 0.082817 0.065288
   1.092408 0.163864 0.065419 0.059027 0.045329 0.089443
10 0.119440 0.116869 1.247649 0.182073 0.256474 0.160276 0.167356 0.126720
   0.132571 1.150674 0.161965 0.048851 0.132340 0.496895
11 0.173454 0.178638 0.955130 0.145649 0.056460 0.182852 0.177641 0.287734
   0.151078 0.253307 1.202757 0.046113 0.095870 0.381249
12 0.101921 0.108460 0.765103 0.119812 0.058191 0.179522 0.184693 0.286405
   0.188413 0.261076 0.216591 1.118924 0.112294 0.302256
13 0.065556 0.005107 0.021771 0.003306 0.003824 0.004818 0.003813 0.011961
   0.003686 0.017157 0.003982 0.001583 1.007000 0.008577
14 0.270745 0.247252 3.029506 0.442526 0.072866 0.304969 0.348623 0.272981
   0.286202 0.326913 0.325748 0.106236 0.205748 1.229018
```

MULT.OUT

The output from the MULT.FOR program contains information on direct, indirect, and induced income effects, including Type I and Type II multipliers.

INCOME MULTIPLIERS

INDUSTRY	DIRECT INCOME CHANGE	DIRECT AND INDIRECT INCOME CHANGE	INDIRECT INCOME CHANGE	TYPE I MULTIPLIER	DIRECT, INDIRECT AND INDUCED INCOME CHANGE	INDUCED INCOME CHANGE	INDIRECT AND INDUCED INCOME CHANGE	TYPE II MULTIPLIER
HARD-ROCK MINING	0.15	0.22	0.07	1.43	0.27	0.05	0.12	1.76
PLACER MINING	0.13	0.20	0.07	1.53	0.25	0.05	0.12	.88
FORESTRY	0.33	0.36	0.03	1.09	0.44	0.08	0.11	.33
OIL AND GAS	2.42	2.46	0.04	1.02	3.03	0.56	0.61	.25
TRANSPORTATION	0.15	0.25	0.10	1.71	0.30	0.06	0.16	.10
CONSTRUCTION	0.17	0.28	0.12	1.72	0.35	0.06	0.18	.11
UTILITIES	0.07	0.22	0.15	3.09	0.27	0.05	0.20	.79
WHOLESALE TRADE	0.10	0.23	0.14	2.41	0.29	0.05	0.19	.[illegible]6
RETAIL TRADE	0.11	0.27	0.15	2.36	0.33	0.06	0.21	.[illegible]0
SERVICES	0.21	0.27	0.05	1.26	0.33	0.06	0.11	.[illegible]4
FINANCE, INSURANCE AND REAL ESTATE	0.05	0.09	0.04	1.84	0.11	0.02	0.06	.26
MANUFACTURING	0.07	0.17	0.10	2.33	0.21	0.04	0.13	.36

YUKCN

Program: IMPACN.FOR
Inputs: YUKCN.DAT
INV.OUT
Outputs: IMPACT.OUT
CHECK.DAT

IMPACN.FOR

This program allows the user to interactively modify one or more final demand values and have the new transactions table produced. Options open to the user and means of implementing them are fully documented and clearly shown during a terminal session in which IMPACN.FOR is run.

```
C
C     THIS PROGRAM ALLOWS THE USER TO INTERACTIVELY MODIFY THE VALUES
C     OF FINAL DEMANDS.  THE PROGRAM THEN CALCULATES THE NEW
C     TRANSACTIONS MATRIX ASSOCIATED WITH THESE FINAL DEMANDS.
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     A=DIRECT REQUIREMENTS MATRIX BY INDUSTRY AND INDUSTRY
C     AH=DIRECT REQUIREMENTS MATRIX WITH THE HOUSEHOLD ROW AND COLUMN
C        INCLUDED BY INDUSTRY AND INDUSTRY
C     FD=FINAL DEMAND MATRIX BY INDUSTRY AND FINAL DEMAND CATEGORY
C     FDVEC=TOTAL FINAL DEMAND BY INDUSTRY
C     HC=HOUSEHOLD COEFFICIENT COLUMN (PERSONAL EXPENDITURE) BY
C        INDUSTRY
C     HR=HOUSEHOLD COEFFICIENT ROW (WAGES, SALARIES AND SUPPLEMENTARY
C        LABOUR INCOME) BY INDUSTRY
C     IAHINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX INCLUDING THE HOUSEHOLD ROW AND COLUMN BY INDUSTRY
C        AND INDUSTRY
C     IAINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX BY INDUSTRY AND INDUSTRY
C     IO=ORIGINAL INPUT-OUTPUT MATRIX BY INDUSTRY OR FINAL PAYMENT
C        CATEGORY AND INDUSTRY OR FINAL DEMAND CATEGORY
C     M=IMPORTS BY INDUSTRY (WHICH PRODUCES THE IMPORT)
C     MFD=FINAL DEMAND AS IT IS MODIFIED BY THE USER BY INDUSTRY AND
C        FINAL DEMAND CATEGORY
C     NETO=NET OUTPUT ASSOCIATED WITH MODIFIED FINAL DEMAND BY
C        INDUSTRY
C     NEWGO=GROSS OUTPUT ASSOCIATED WITH MODIFIED FINAL DEMAND BY
C        INDUSTRY
C     NEWIO=INPUT-OUTPUT MATRIX ASSOCIATED WITH MODIFIED FINAL DEMAND
C        BY INDUSTRY OR FINAL PAYMENT CATEGORY AND IDUSTRY OR FINAL
C        DEMAND CATEGORY
C     NEWM=IMPORTS ASSOCIATED WITH MODIFIED FINAL DEMAND BY INDUSTRY
C        (WHICH PRODUCES THE IMPORT)
C     NEWTOT=TOTAL FINAL DEMAND ASSOCIATED WITH MODIFIED FINAL DEMAND
C         BY INDUSTRY OR FINAL PAYMENT CATEGORY AND FINAL DEMAND
C        CATEGORY
C     NRLY=RESIDUAL LABOUR INCOME ASSOCIATED WITH MODIFIED FINAL DEMAND
C        DEMAND BY INDUSTRY
C     RLY=RESIDUAL LABOUR INCOME BY INDUSTRY
C
C     INTEGER AND COUNTER VARIABLES
C
C     I=COUNTER VARIABLE
C     J=COUNTER VARIABLE
C     NFD=ALPHABETIC LETTER FOR FINAL DEMAND CATEGORY ASSOCIATED WITH
C        NUMERIC COUNTER BY FINAL DEMAND CATEGORY
C     NN=CODE FOR 'N' (OR NO) ANSWER
C     NUCHG=INDICATES CHANGES HAVE BEEN MADE TO FINAL DEMAND CATEGORY
C        IF NON-ZERO BY FINAL DEMAND CATEGORY
```

```
C     NY=CODE FOR 'Y' (OR YES) ANSWER
C     R1, R2, R3, R4 AND R5=USER RESPONSE TO QUESTIONS
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;

C        13=MANUFACTURING; 14=HOUSEHOLDS
C     FINAL DEMAND CATEGORIES:  15 (OR 1)=VALUE OF PHYSICAL CHANGE IN
C        INVENTORIES; 16 (OR 2)=EXPORTS; 17 (OR 3)=GOVERNMENT;
C        18 (OR 4)=GROSS FIXED CAPITAL FORMATION; 19 (OR 5)=CONSUMPTION
C     FINAL PAYMENT CATEGORIES:  15=INDIRECT TAXES LESS SUBSIDIES;
C        16=OTHER OPERATING SURPLUS; 17= DEPRECIATION; 18=NET INCOME
C        OF UNINCORPORATED BUSINESS; 19=LABOUR INCOME; 20=IMPORTS
C     OTHER COLUMN COUNTERS:  14=SUM OF COLUMNS 1 TO 13; 20=SUM OF
C        COLUMNS 15 TO 19; 21=SUM OF COLUMNS 14 AND 20
C     OTHER ROW COUNTERS:  14=SUM OF ROWS 1 TO 13; 21=SUM OF ROWS 15
C        TO 19; 22 =SUM OF ROWS 14 AND 21
C
      REAL*8 A(13,13)
      REAL*8 AH(14,14)
      REAL*8 FD(14,5)
      REAL*8 FDVEC(14)
      REAL*8 HC(14)
      REAL*8 HR(14)
      REAL*8 IAHINV(14,14)
      REAL*8 IAINV(13,13)
      REAL*8 IO(22,22)
      REAL*8 M(22)
      REAL*8 MFD(14,5)
      REAL*8 NETO(13)
      REAL*8 NEWGO(14)
      REAL*8 NEWIO(22,22)
      REAL*8 NEWM(13)
      REAL*8 NEWTOT(5)
      REAL*8 NRLY(13)
      REAL*8 RLY(13)
C
      INTEGER I, J, NFD(5), NN, NOCHG(5), NY
      INTEGER R1, R2, R3, R4, R5
C
      DATA A /169*0D0/
      DATA AH /196*0D0/
      DATA FD /70*0D0/
      DATA FDVEC /14*0D0/
      DATA HC /14*0D0/
      DATA HR /14*0D0/
      DATA IAHINV /196*0D0/
      DATA IAINV /169*0D0/
      DATA IO /484*0D0/
      DATA M /22*0D0/
      DATA MFD /70*0D0/
      DATA NETO /13*0D0/
      DATA NEWGO /14*0D0/
      DATA NEWIO /484*0D0/
      DATA NEWM /13*0D0/
      DATA NEWTUT /5*0D0/
      DATA NPLY /13*0D0/
      DATA RLY /13*0D0/
C
      DATA NN /'N'/
      DATA NOCHG /5*0D0/
      DATA NY /'Y'/
C
      OPEN(UNIT=5,DEVICE='TTY')
      OPEN(UNIT=6,DEVICE='TTY')
      OPEN(UNIT=8,DEVICE='DSK',FILE='YUKON.DAT')
      OPEN(UNIT=9,DEVICE='DSK',FILE='INV.OUT')
      OPEN(UNIT=10,DEVICE='DSK',FILE='IMPACT.OUT')
      OPEN(UNIT=12,DEVICE='DSK',FILE='CHECK.DAT')
C
C     INPUT ROUTINE
C
      DO 1 I=1,13
1     READ(9,2)(A(I,J),J=1,13)
2     FORMAT(3X,8F9.6/3X,5F9.6)
      READ(9,3)(HR(I),I=1,14)
3     FORMAT(3X,8F9.6/3X,6F9.6)
      READ(9,3)(HC(I),I=1,14)
      DO 4 I=1,13
4     READ(9,2)(IAINV(I,J),J=1,13)
      DO 5 I=1,14
5     READ(9,3)(IAHINV(I,J),J=1,14)
      DO 6 I=1,22
6     READ(8,7)(TO(I,J),J=1,22)
7     FORMAT(3X,8F9.0/3X,8F9.0/3X,6F9.0)
      DO 8 I=1,14
8     READ(8,9)(FD(I,J),J=1,5)
9     FORMAT(3X,5F9.0)
      READ(8,7)(M(I),I=1,22)
10    FORMAT(3X,8F9.0/3X,5F9.0)
      READ(8,10)(RLY(I),I=1,13)
      DO 15 I=1,13
      DO 15 J=1,13
15    AH(I,J)=A(I,J)
      DO 16 I=1,13
16    AH(I,14)=HC(I)
      DO 17 J=1,14
17    AH(14,J)=HR(J)
      NFD(1)='A'
      NFD(2)='B'
      NFD(3)='C'
      NFD(4)='D'
      NFD(5)='E'
C
C     SELECTION OF OPTION
C
      WRITE(6,40)
40    FORMAT(' WELCOME TO THE INTERACTIVE FINAL DEMAND MODIFICATION')
      WRITE(6,41)
41    FORMAT(' ROUTINE OF THE IMPACT CALCULATION PROGRAM.')
49    FORMAT(' RESPONSE INVALID - PLEASE RE-TYPE')
```

```
C
C       FINAL DEMAND MODIFICATION.
C
        DO 140 I=1,13
        DO 140 J=1,5
140     MFD(I,J)=FD(I,J)
        WRITE(6,55)
55      FORMAT(' FINAL DEMAND CATEGORIES:')
        WRITE(6,56)
56      FORMAT('   A. VALUE OF THE PHYSICAL CHANGE IN INVENTORIES')
        WRITE(6,57)
57      FORMAT('   B. EXPORTS')
        WRITE(6,58)
58      FORMAT('   C. GOVERNMENT')
        WRITE(6,59)

59      FORMAT('   D. GROSS FIXED CAPITAL FORMATION')
        WRITE(6,60)
60      FORMAT('   E. CONSUMPTION')
        WRITE(6,61)
61      FORMAT(' INDUSTRY CATEGORIES:')
        WRITE(6,62)
62      FORMAT('   1. HARD-ROCK MINING')
        WRITE(6,63)
63      FORMAT('   2. PLACER MINING')
        WRITE(6,64)
64      FORMAT('   3. OIL AND GAS')
        WRITE(6,65)
65      FORMAT('   4. FORESTRY')
        WRITE(6,66)
66      FORMAT('   5. FISHING, HUNTING, TRAPPING AND SUBSISTENCE')
        WRITE(6,67)
67      FORMAT('   6. TRANSPORTATION')
        WRITE(6,68)
68      FORMAT('   7. CONSTRUCTION')
        WRITE(6,69)
69      FORMAT('   8. UTILITIES')
        WRITE(6,70)
70      FORMAT('   9. WHOLESALE TRADE')
        WRITE(6,71)
71      FORMAT('  10. RETAIL TRADE')
        WRITE(6,72)
72      FORMAT('  11. SERVICES')
        WRITE(6,73)
73      FORMAT('  12. FINANCE, INSURANCE, AND REAL ESTATE')
        WRITE(6,74)
74      FORMAT('  13. MANUFACTURING')
        WRITE(6,75)
75      FORMAT(' DO YOU WISH TO REVIEW THE DEFAULT FINAL DEMAND')
        WRITE(6,76)
76      FORMAT(' VALUES FOR EACH INDUSTRY? (TYPE Y OR N)')
79      READ(5,77)R2
77      FORMAT(A1)
        IF(R2.EQ.NY.OR.R2.EQ.NN)GO TO 78
        WRITE(6,49)
        GO TO 79
```

```
 78     IF(R2.EQ.NN)GO TO 80
        CALL WRITFD(FD,R1)
 80     WRITE(6,81)
 81     FORMAT(' DO YOU WISH TO CHANGE ANY OF THE DEFAULT VALUES')
        WRITE(6,82)
 82     FORMAT(' OF FINAL DEMAND? (TYPE Y OR N)')
 85     READ(5,83)R3
 83     FORMAT(A1)
        IF(R3.EQ.NY.OR.R3.EQ.NN)GO TO 84
        WRITE(6,49)
        GO TO 85
 84     IF(R3.EQ.NN)GO TO 95
        WRITE(6,86)
 86     FORMAT(' WHICH CATEGORY? (TYPE A, B, C, D, OR E)')
 92     READ(5,87)R4
 87     FORMAT(A1)
        DO 88 I=1,5
        IF(R4.EQ.NFD(I))GO TO 89
 88     CONTINUE
        WRITE(6,49)

        GO TO 92
 89     R4=I
        CALL READFD(MFD,R1,R4)
        NOCHG(R4)=1
        WRITE(6,91)
 91     FORMAT(' DO YOU HAVE ANY OTHER CHANGES? (TYPE Y OR N)')
        GO TO 85
 95     WRITE(6,150)
 150    FORMAT(' DO YOU WISH TO SEE THE NEW FINAL DEMAND VALUES?')
        WRITE(6,151)
 151    FORMAT(' (TYPE Y OR N)')
 152    READ(5,153) R5
 153    FORMAT(A1)
        IF (R5.EQ.NY.OR.R5.EQ.NN) GO TO 154
        WRITE(6,49)
        GO TO 152
 154    IF (R5.EQ.NN) GO TO 155
        CALL WRITFD(MFD,R1)
 155    WRITE(6,96)
 96     FORMAT(' THE TRANSACTIONS TABLE CORRESPONDING TO THESE FINAL')
        WRITE(6,97)
 97     FORMAT(' DEMAND VALUES WILL NOW BE CALCULATED AND PRINTED AT')
        WRITE(6,98)
 98     FORMAT(' THE LINE PRINTER')
C
C       OPTION 1:  IMPACT CALCULATION
C
        DO 102 J=1,5
        DO 102 I=1,13
 102    FDVEC(I)=FDVEC(I)+MFD(I,J)
        DO 103 I=1,13
        DO 103 J=1,13
 103    NEWGO(I)=NEWGO(I)+IAINV(I,J)*FDVEC(J)
        DO 104 I=1,13
        DO 104 J=1,13
 104    NEWIO(I,J)=A(I,J)*NEWGO(J)
```

```
      DO 105 I=1,13
      DO 105 J=1,13
105   NEWIO(14,J)=NEWIO(14,J)+NEWIO(I,J)
      DO 106 I=1,13
      DO 106 J=1,13
106   NEWIO(I,14)=NEWIO(I,14)+NEWIO(I,J)
      DO 107 J=1,13
107   NEWIO(14,14)=NEWIO(14,14)+NEWIO(14,J)
      DO 108 I=1,13
      DO 108 J=15,19
108   NEWIO(I,J)=MFD(I,J-14)
      DO 109 I=1,13
      DO 109 J=15,19
109   NEWIO(14,J)=NEWIO(14,J)+NEWIO(I,J)
      DO 110 I=1,13
      DO 110 J=15,19
110   NEWIO(I,21)=NEWIO(I,21)+NEWIO(I,J)
      DO 111 J=15,19
111   NEWIO(14,21)=NEWIO(14,21)+NEWIO(14,J)
      DO 112 I=1,14
112   NEWIO(I,22)=NEWIO(I,14)+NEWIO(I,21)
      DO 120 I=15,20
      DO 120 J=1,13
120   NEWIO(I,J)=(IO(I,J)/IO(22,J))*NEWGO(J)

       DO 121 I=15,20
       DO 121 J=1,13
 121   NEWIO(I,14)=NEWIO(I,14)+NEWIO(I,J)
       DO 122 J=15,19
 122   NEWIOT(J-14)=NEWIO(14,J)*(IO(22,J)/IO(14,J))
       DO 123 I=15,20
       DO 123 J=15,19
 123   NEWIO(I,J)=(IO(I,J)/IO(22,J))*NEWIOT(J-14)
       DO 124 I=15,20
       DO 124 J=15,19
 124   NEWIO(I,21)=NEWIO(I,21)+NEWIO(I,J)
       DO 125 I=15,20
 125   NEWIO(I,22)=NEWIO(I,14)+NEWIO(I,21)
       DO 126 I=15,20
       DO 126 J=1,22
 126   NEWIO(21,J)=NEWIO(21,J)+NEWIO(I,J)
       DO 127 J=1,22
 127   NEWIO(22,J)=NEWIO(14,J)+NEWIO(21,J)
       DO 130 I=1,13
 130   NEWM(I)=NEWGO(I)*(M(I)/IO(I,22))
       DO 131 I=1,13
 131   NETO(I)=NEWGO(I)-NEWM(I)
       GO TO 300
C
C      DISK FILE OUTPUT ROUTINE
C
300    WRITE(10,420)(NEWGO(I),I=1,13)
420    FORMAT(' NO',8F9.0/3X,5F9.0)
       DO 421 I=1,13
421    WRITE(10,422) I,(NEWIO(I,J),J=15,19)
422    FORMAT(I3,5F9.0)
```

```
C
C     LINE PRINTER OUTPUT ROUTINE
C
      WRITE(12,301)
301   FORMAT('1',55X,'NEW TRANSACTIONS TABLE')
      WRITE(12,302)
302   FORMAT(' ',63X,'PAGE 1')
      WRITE(12,303)
303   FORMAT('0',56X,'THOUSANDS OF DOLLARS')
      WRITE(12,304)
304   FORMAT('0',85X,'FISHING, HUNTING,')
      WRITE(12,305)
305   FORMAT(' ',33X,'HARD-ROCK',7X,'PLACER',33X,'TRAPPING AND',5X,
     1 'TRANS-')
      WRITE(12,306)
306   FORMAT(' INDUSTRY',27X,'MINING',8X,'MINING',5X,'OIL AND GAS',5X,
     1 'FORESTRY',4X,'SUBSISTENCE',4X,'PORTATION',4X,'CONSTRUCTION')
      WRITE(12,307)(NEW10(1,J),J=1,7)
307   FORMAT('-',16HHARD-ROCK MINING,11X,7F14.0)
      WRITE(12,308)(NEW10(2,J),J=1,7)
308   FORMAT('-',13HPLACER MINING,14X,7F14.0)
      WRITE(12,309)(NEW10(3,J),J=1,7)
309   FORMAT('-',11HOIL AND GAS,16X,7F14.0)
      WRITE(12,310)(NEW10(4,J),J=1,7)
310   FORMAT('-',8HFORESTRY,19X,7F14.0)
      WRITE(12,311)
311   FORMAT('0FISHING, HUNTING, TRAPPING')
      WRITE(12,312)(NEW10(5,J),J=1,7)
312   FORMAT(' ',15HAND SUBSISTENCE,12X,7F14.0)

      WRITE(12,313)(NEW10(6,J),J=1,7)
313   FORMAT('-',14HTRANSPORTATION,13X,7F14.0)
      WRITE(12,314)(NEW10(7,J),J=1,7)
314   FORMAT('-',12HCONSTRUCTION,15X,7F14.0)
      WRITE(12,315)(NEW10(8,J),J=1,7)
315   FORMAT('-',9HUTILITIES,18X,7F14.0)
      WRITE(12,316)(NEW10(9,J),J=1,7)
316   FORMAT('-',15HWHOLESALE TRADE,12X,7F14.0)
      WRITE(12,317)(NEW10(10,J),J=1,7)
317   FORMAT('-',12HRETAIL TRADE,15X,7F14.0)
      WRITE(12,318)(NEW10(11,J),J=1,7)
318   FORMAT('-',8HSERVICES,19X,7F14.0)
      WRITE(12,319)
319   FORMAT('0FINANCE, INSURANCE')
      WRITE(12,320)(NEW10(12,J),J=1,7)
320   FORMAT(' ',15HAND REAL ESTATE,12X,7F14.0)
      WRITE(12,321)(NEW10(13,J),J=1,7)
321   FORMAT('-',13HMANUFACTURING,14X,7F14.0)
      WRITE(12,324)(NEW10(14,J),J=1,7)
324   FORMAT('-',16HTOTAL PROCESSING,11X,7F14.0)
      WRITE(12,322)
322   FORMAT('0INDIRECT TAXES')
      WRITE(12,323)(NEW10(15,J),J=1,7)
323   FORMAT(' ',14HLESS SUBSIDIES,13X,7F14.0)
      WRITE(12,325)
325   FORMAT('0OTHER OPERATING')
      WRITE(12,326)(NEW10(16,J),J=1,7)
326   FORMAT(' ',7HSURPLUS,20X,7F14.0)
```

```
      WRITE(12,327)(NEW10(17,J),J=1,7)
327   FORMAT('-',12HDEPRECIATION,15X,7F14.0)
      WRITE(12,328)
328   FORMAT('0NET INCOME OF UNINCOR-')
      WRITE(12,329)(NEW10(18,J),J=1,7)
329   FORMAT(' ',16HPORATED BUSINESS,11X,7F14.0)
      WRITE(12,330)(NEW10(19,J),J=1,7)
330   FORMAT('-',13HLABOUR INCOME,14X,7F14.0)
      WRITE(12,331)(NEW10(20,J),J=1,7)
331   FORMAT('-',7HIMPORTS,20X,7F14.0)
      WRITE(12,332)
332   FORMAT('0TOTAL FINAL')
      WRITE(12,333)(NEW10(21,J),J=1,7)
333   FORMAT(' ',8HPAYMENTS,19X,7F14.0)
      WRITE(12,334)(NEW10(22,J),J=1,7)
334   FORMAT('-',13HTOTAL OUTLAYS,14X,7F14.0)
      WRITE(12,400)
400   FORMAT('1',55X,'NEW TRANSACTIONS TABLE')
      WRITE(12,401)
401   FORMAT(' ',63X,'PAGE 2')
      WRITE(12,402)
402   FORMAT('0',56X,'THOUSANDS OF DOLLARS')
      WRITE(12,403)
403   FORMAT('0',90X,'FINANCE,',21X,'TOTAL')
      WRITE(12,404)
404   FORMAT(' ',47X,'WHOLESALE',7X,'RETAIL',18X,'INSURANCE AND',4X,
     1 'MANUFAC-',4X,'INTERMEDIATE')
      WRITE(12,405)
405   FORMAT(' INDUSTRY',25X,'UTILITIES',7X,'TRADE',9X,'TRADE',8X,
     1 'SERVICES',4X,'REAL ESTATE',6X,'TURING',6X,'PRODUCTION')
      WRITE(12,307)(NEW10(1,J),J=8,14)
      WRITE(12,308)(NEW10(2,J),J=8,14)

      WRITE(12,309)(NEW10(3,J),J=8,14)
      WRITE(12,310)(NEW10(4,J),J=8,14)
      WRITE(12,311)
      WRITE(12,312)(NEW10(5,J),J=8,14)
      WRITE(12,313)(NEW10(6,J),J=8,14)
      WRITE(12,314)(NEW10(7,J),J=8,14)
      WRITE(12,315)(NEW10(8,J),J=8,14)
      WRITE(12,316)(NEW10(9,J),J=8,14)
      WRITE(12,317)(NEW10(10,J),J=8,14)
      WRITE(12,318)(NEW10(11,J),J=8,14)
      WRITE(12,319)
      WRITE(12,320)(NEW10(12,J),J=8,14)
      WRITE(12,321)(NEW10(13,J),J=8,14)
      WRITE(12,324)(NEW10(14,J),J=8,14)
      WRITE(12,322)
      WRITE(12,323)(NEW10(15,J),J=8,14)
      WRITE(12,325)
      WRITE(12,326)(NEW10(16,J),J=8,14)
      WRITE(12,327)(NEW10(17,J),J=8,14)
      WRITE(12,328)
      WRITE(12,329)(NEW10(18,J),J=8,14)
      WRITE(12,330)(NEW10(19,J),J=8,14)
      WRITE(12,331)(NEW10(20,J),J=8,14)
      WRITE(12,332)
      WRITE(12,333)(NEWIO(21,J),J=8,14)
      WRITE(12,334)(NEWIO(22,J),J=8,14)
      WRITE(12,450)
450   FORMAT('1',55X,'NEW TRANSACTIONS TABLE')
      WRITE(12,451)
451   FORMAT(' ',63X,'PAGE 3')
      WRITE(12,452)
452   FORMAT('0',56X,'THOUSANDS OF DOLLARS')
      WRITE(12,453)
453   FORMAT('0',34X,'VALUE OF')
      WRITE(12,454)
454   FORMAT(' ',34X,'PHYSICAL',32X,'GROSS FIXED',34X,'TOTAL')
      WRITE(12,455)
455   FORMAT(' ',33X,'CHANGE IN',34X,'CAPITAL',36X,'GROSS')
      WRITE(12,456)
456   FORMAT(' INDUSTRY',24X,'INVENTORIES',5X,'EXPORTS',6X,'GOVERNMENT'
     1 ,4X,'FORMATION',4X,'CONSUMPTION',7X,'GDP',10X,'OUTPUT')
      WRITE(12,307)(NEWIO(1,J),J=15,19),NEWIO(1,21),NEWIO(1,22)
      WRITE(12,308)(NEWIO(2,J),J=15,19),NEWIO(2,21),NEWIO(2,22)
      WRITE(12,309)(NEWIO(3,J),J=15,19),NEWIO(3,21),NEWIO(3,22)
      WRITE(12,310)(NEWIO(4,J),J=15,19),NEWIO(4,21),NEWIO(4,22)
      WRITE(12,311)
      WRITE(12,312)(NEWIO(5,J),J=15,19),NEWIO(5,21),NEWIO(5,22)
      WRITE(12,313)(NEWIO(6,J),J=15,19),NEWIO(6,21),NEWIO(6,22)
      WRITE(12,314)(NEWIO(7,J),J=15,19),NEWIO(7,21),NEWIO(7,22)
      WRITE(12,315)(NEWIO(8,J),J=15,19),NEWIO(8,21),NEWIO(8,22)
      WRITE(12,316)(NEWIO(9,J),J=15,19),NEWIO(9,21),NEWIO(9,22)
      WRITE(12,317)(NEWIO(10,J),J=15,19),NEWIO(10,21),NEWIO(10,22)
      WRITE(12,318)(NEWIO(11,J),J=15,19),NEWIO(11,21),NEWIO(11,22)
      WRITE(12,319)
      WRITE(12,320)(NEWIO(12,J),J=15,19),NEWIO(12,21),NEWIO(12,22)
      WRITE(12,321)(NEWIO(13,J),J=15,19),NEWIO(13,21),NEWIO(13,22)
      WRITE(12,324)(NEWIO(14,J),J=15,19),NEWIO(14,21),NEWIO(14,22)
      WRITE(12,322)
      WRITE(12,323)(NEWIO(15,J),J=15,19),NEWIO(15,21),NEWIO(15,22)
      WRITE(12,325)

      WRITE(12,326)(NEWIO(16,J),J=15,19),NEWIO(16,21),NEWIO(16,22)
      WRITE(12,327)(NEWIO(17,J),J=15,19),NEWIO(17,21),NEWIO(17,22)
      WRITE(12,328)
      WRITE(12,329)(NEWIO(18,J),J=15,19),NEWIO(18,21),NEWIO(18,22)
      WRITE(12,330)(NEWIO(19,J),J=15,19),NEWIO(19,21),NEWIO(19,22)
      WRITE(12,331)(NEWIO(20,J),J=15,19),NEWIO(20,21),NEWIO(20,22)
      WRITE(12,332)
      WRITE(12,333)(NEWIO(21,J),J=15,19),NEWIO(21,21),NEWIO(21,22)
      WRITE(12,334)(NEWIO(22,J),J=15,19),NEWIO(22,21),NEWIO(22,22)
      STOP
      END
      SUBROUTINE READFD(NFD,R1,R4)
C
C     THIS SUBROUTINE READS THE NEW FINAL DEMAND VALUES WHICH THE USER
C     INPUTS AT THE TERMINAL
C
C     VARIABLE GLOSSARY AND DECLARATION
C
C     REAL VARIABLES
C
```

```
C     MFD=NEW VALUES OF FINAL DEMAND BY INDUSTRY AND FINAL DEMAND
C        CATEGORY
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER VARIABLE FOR INDUSTRY; I=1,2,...,13
C     R1=INDICATES OPTION 1 (HOUSEHOLDS EXOGENOUS) AND 2 (HOUSEHOLDS
C        ENDOGENOUS)
C     R4=FINAL DEMAND CATEGORY TO BE MODIFIED
C
      REAL*8 MFD(14,5)
C
      INTEGER I, R1, R4
C
      IF (R1.EQ.'2') GO TO 3
      WRITE(6,1)
1     FORMAT(' TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 13,')
      WRITE (6,2)
2     FORMAT(' SEPARATED BY COMMAS')
      READ(6,*)(MFD(I,R4),I=1,13)
      RETURN
3     WRITE(6,4)
4     FORMAT(' TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 14,')
      WRITE (6,5)
5     FORMAT(' SEPARATED BY COMMAS')
      READ(6,*)(MFD(I,R4),I=1,14)
      RETURN
      END
      SUBROUTINE WRITFD(FD,R1)
C
C     THIS SUBROUTINE WRITES ALL THE VALUES OF FINAL DEMAND AT THE
C     TERMINAL
C
C     VARIABLE GLOSSARY AND DECLARATION
C
C     REAL VARIABLES
C
C     FD=VALUES OF FINAL DEMAND BY INDUSTRY AND FINAL DEMAND CATEGORY
C
C     INTEGER VARIABLES AND COUNTERS


C
C     I=COUNTER VARIABLE FOR INDUSTRY; I=1,2,...,13
C     NI=NUMBER OF INDUSTRIES
C     R1=INDICATES OPTION 1 (HOUSEHOLDS EXOGENOUS) AND 2 (HOUSEHOLDS
C        ENDOGENOUS)
C
      REAL*8 FD(14,5)
C
      INTEGER I, NI, R1
C
      IF (R1.EQ.'1') NI=13
      IF (R1.EQ.'2') NI=14
       NI=13
      WRITE(6,1)
1     FORMAT(' A. VALUE OF PHYSICAL CHANGE IN INVENTORIES')
      WRITE(6,2)(I,FD(I,1),I=1,NI)
```

```
2     FORMAT(I3,F10.1)
      WRITE(6,3)
3     FORMAT(' B. EXPORTS')
      WRITE(6,2)(I,FD(I,2),I=1,NI)
      WRITE(6,4)
4     FORMAT(' C. GOVERNMENT')
      WRITE(6,2)(I,FD(I,3),I=1,NI)
      WRITE(6,5)
5     FORMAT(' D. GROSS FIXED CAPITAL FORMATION')
      WRITE(6,2)(I,FD(I,4),I=1,NI)
      IF (R1.EQ.'2') RETURN
      WRITE(6,6)
6     FORMAT(' E. CONSUMPTION')
      WRITE(6,2)(I,FD(I,5),I=1,NI)
      RETURN
      END
```

YUKON.DAT

This data set contains the initial 1978 transactions table.

```
  1         0         0         0         0         0         0         0         0
            0         0         0         0         0         0     17378    133213
            0         0         0         0    150591    150591
  2         0         0         0         0         0         0         0         0
          859         0         0         0       860      1719         0      1247
            0         0         0         0      1247      2966
  3         0         0         0         0         0         0         0         0
            0         0         0         0         0         0         0        57
            0         0         0         0        57        57
  4       170         0         0         0         0         0       182         0
            0         0         0         0      1594      1946         0         0
          119         0         0         0       119      2065
  5         0         0         0         0         0         0         0         0
            0         0         0         0         0         0         0       934
            0         0      3696         0      4630      4630
  6     14193       160         6        80         0      1403      8519      2711
        17047      9179      1775        26       264     55380         0         0
         2560         0         0         0      2560     57960
  7       584        46         1       130         0     11740     19001      4114
        13359     15384       434      3020         4     67817         0         0
         2302     11398         0         0     13700     81517
  8      7177         5         0         5         0       681      619_       787
          743      1115      1053       929       268     13382         0       724
          238         0      7167         0      8149     21531
  9      2584       337         2         3         0      2366      2345       209
         2591      7651      1766      1862        89     22007         0         0
        24486     24961         0         0     49447     71454
 10        55        29         1         0      1032      1578      1155         0
           81       179      1757       123       515      6505         0     25687
         7183         0     37571         0     70441     76946
 11      9303       234         0         0         0      3265      2799      3287
         1399      8085      5695       113        69     34269         0     12983
         2143         0     21027         0     36153     70422
 12        36        38         0         0         0      3280      3925      3087
         4221      8281      7179      3280       409     33736         0      1309
            0         0     11810         0     13119     46855
 13      9403         8         0         0         0        93        28       186
           34      1045        59        18        49     10923         0         0
          635         0         0         0       635     11558
 14     43505       857        10       216      1032     24408     38570     14381
        40334     51119     19718      9371      4161    247684     17378    176154
        39686     36359     81291         0    350868    598552
 15       840         0         7        76         4      1746      3004        -2
            1       211      2332      3877        43     12139         0         0
            0         0         0         0         0     12139
 16     35234         0      -193     -9169         0    -23254      7573         0
         1982      2326     13065     28966      2137     58689         0         0
            0         0         0         0         0     58689
 17     13096         0         0      9822         0     35360      4584         0
          121       141      4636       180       196     68136         0         0
         9801         0      3249         0     13101     61237
```

```
18          0       673         0        10      3594         0       657       210
           98       914      3053       556        46      9761         0         0
            0         0      7047         0      7047     16808
19      37053       624       220      1095         0     13460     21553      2479
        11059     13663     23745      3515      1330    129996         0         0
        50226         0         0         0     50226    180222
20      20863       862        13        13         0      6240      5576      4463
        17859      8372      3853       388      3645     72147       225         0




         6969     78244      7181         0     92619    164766
21     107086      2109        47      1847      3598     33552     42947      7150
        31120     25827     50704     37484      7397    350868       225         0
        67056     78244     17468         0    162993    513661
22     150591      2966        57      2065      4630     57960     81517     21531
        71454     76946     70422     46855     11558    598552     17603    176154
       106742    114603     98759         0    513861   1112413
 1      17378    133213         0         0         0
 2          0      1247         0         0         0
 3          0        57         0         0         0
 4          0         0       119         0         0
 5          0       934         0         0      3696
 6          0         0      2580         0         0
 7          0         0      2302     11398         0
 8          0       724       238         0      7187
 9          0         0     24486     24961         0
10          0     25687      7163         0     37571
11          0     12983      2143         0     21027
12          0      1309         0         0     11810
13          0         0       635         0         0
14          0         0     50226         0         0
 M      20863       862        13        13         0      6240      5576      4463
        17859      8372      3853       388      3645     72147       225         0
         6969     78244      7181         0     92619    164766
RY      13822       234        82       410         0      5043      8075       929
         4143      5194      8896      1317       498
```

INV.OUT

The direct plus indirect requirements matrices appear on the following pages for both the closed economy and open economy. The closed system is distinguished from the open system in that the household sector (Consumption column and Labour Income row) becomes part of the inter-industry matrix.

```
 1 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.012020 0.000000 0.000000 0.000000 0.074410
 3 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001130 0.000000 0.000000 0.000000 0.000000 0.000000 0.002230 0.000000
   0.000000 0.000000 0.000000 0.000000 0.137910
 5 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.094250 0.053940 0.105260 0.038740 0.000000 0.024210 0.104470 0.125910
   0.238570 0.119290 0.025210 0.000550 0.024570
 7 0.003880 0.015510 0.017540 0.062950 0.000000 0.202550 0.233090 0.191070
   0.186960 0.199930 0.006160 0.064450 0.000350
 8 0.047660 0.001690 0.000000 0.002420 0.000000 0.011750 0.007590 0.036550
   0.010400 0.014490 0.014950 0.019830 0.023190
 9 0.017160 0.113620 0.035090 0.001450 0.000000 0.040860 0.028770 0.009710
   0.036260 0.102030 0.025080 0.039740 0.007700
10 0.000370 0.009780 0.017540 0.000000 0.222890 0.027230 0.014170 0.000000
   0.001130 0.002330 0.024950 0.002630 0.044560
11 0.061780 0.078890 0.000000 0.000000 0.000000 0.056330 0.034340 0.152660
   0.019580 0.105070 0.080870 0.002410 0.007700
12 0.000240 0.012810 0.000000 0.000000 0.000000 0.056590 0.048150 0.143370
   0.059070 0.107620 0.101940 0.070000 0.035390
13 0.062440 0.002700 0.000000 0.000000 0.000000 0.001600 0.000340 0.008640
   0.000480 0.013580 0.000840 0.000380 0.004240
HR 0.153870 0.131490 2.421050 0.331720 0.000000 0.145220 0.165340 0.071990
   0.096790 0.112660 0.210860 0.046910 0.071980 0.000000
HC 0.000000 0.000000 0.000000 0.000000 0.037420 0.000000 0.000000 0.072770
   0.000000 0.380430 0.212910 0.119560 0.000000 0.000000
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.005117 1.001835 0.000625 0.000111 0.000622 0.001002 0.000793 0.001294
   0.013006 0.002791 0.000629 0.000679 0.075189
 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.010059 0.000669 0.000261 1.000256 0.000645 0.001101 0.003274 0.002163
   0.001043 0.002895 0.000364 0.000364 0.138615
 5 0.000000 0.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.124485 0.103195 0.131732 0.053655 0.046284 1.085866 0.169616 0.191875
   0.308248 0.207654 0.051515 0.030405 0.059619
 7 0.066763 0.090920 0.078109 0.101118 0.064339 0.327445 1.383050 0.348295
   0.363266 0.378388 0.057491 0.120234 0.061935
 8 0.055686 0.006054 0.003752 0.004457 0.006417 0.020688 0.017139 1.051670
   0.021904 0.028789 0.021934 0.024710 0.028733
 9 0.031606 0.131717 0.048085 0.007863 0.031221 0.066684 0.057445 0.045422
   1.071579 0.140073 0.041712 0.051295 0.030355
10 0.009977 0.016904 0.022811 0.003159 0.227014 0.036976 0.026406 0.016353
   0.016858 1.018503 0.030264 0.005900 0.049155
11 0.089467 0.101939 0.015358 0.006375 0.033856 0.088249 0.069496 0.203053
   0.062296 0.151897 1.101708 0.015158 0.032045
12 0.035336 0.047653 0.020048 0.010980 0.040271 0.104521 0.098955 0.219270
   0.118027 0.180677 0.136479 1.092797 0.061694
13 0.063066 0.003381 0.000627 0.000218 0.003315 0.002690 0.001380 0.010056
   0.001689 0.014875 0.001709 0.000841 1.005564
 1 1.000000 0.000000 0.000000  .000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.005495 1.002180 0.004848 0.000728 0.000724 0.001427 0.001279 0.001675
   0.013405 0.003246 0.001083 0.000827 0.075476 0.001713
```

```
 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.010440 0.001017 0.004521 1.000878 0.000746 0.001530 0.003765 0.002547
   0.001445 0.003355 0.000822 0.000534 0.139105 0.001729
 5 0.010131 0.009252 0.113364 0.010559 1.002727 0.011412 0.013045 0.010215
   0.010710 0.012233 0.012189 0.003975 0.007699 0.045990
 6 0.154077 0.130219 0.402846 0.102022 0.054246 1.119198 0.207720 0.221711
   0.339526 0.243364 0.087116 0.042016 0.082107 0.134327
 7 0.120660 0.140140 0.681191 0.189211 0.098644 0.388155 1.452450 0.402637
   0.420240 0.443406 0.122337 0.141363 0.102694 0.244600
 8 0.081500 0.031629 0.292607 0.040651 0.013364 0.049706 0.050380 1.077698
   0.049192 0.059960 0.052993 0.034840 0.048351 0.117184
 9 0.051310 0.149711 0.208562 0.040069 0.036524 0.088878 0.082817 0.065288
   1.092406 0.163804 0.005419 0.059027 0.045329 0.089443
10 0.119440 0.116809 1.247649 0.182073 0.256474 0.160276 0.167356 0.126720
   0.132571 1.150674 0.101965 0.046851 0.132340 0.490895
11 0.173454 0.176638 0.955130 0.145649 0.056460 0.182852 0.177641 0.287734
   0.151078 0.253307 1.202757 0.048113 0.095870 0.381249
12 0.101921 0.106400 0.705103 0.119812 0.058191 0.179522 0.184693 0.286405
   0.189413 0.261076 0.216591 1.118924 0.112294 0.302256
13 0.065556 0.005107 0.021771 0.003306 0.003624 0.004818 0.003613 0.011961
   0.003686 0.017157 0.003982 0.001583 1.007000 0.008577
14 0.270745 0.247252 3.029506 0.442526 0.072660 0.304969 0.348623 0.272981
   0.266202 0.320913 0.325748 0.106236 0.205748 1.229018
```

IMPACT.OUT

This output of IMPACN.FOR contains total outlays of industries 1 to 13 and final demand values of 5 sectors for output of industries 1 to 13.

```
NO  150591.     2960.       57.      2065.      4630.
     71455.    76947.    70423.     46855.     11558.     57961.     81517.     21531.
 1   17378.   133213.        0.         0.         0.
 2       0.     1247.        0.         0.         0.
 3       0.       57.        0.         0.         0.
 4       0.        0.      119.         0.         0.
 5       0.      934.        0.         0.         0.
 6       0.        0.     2580.         0.      3696.
 7       0.        0.     2302.         0.         0.
 8       0.      724.      238.     11398.         0.
 9       0.        0.    24486.     24961.         0.
10       0.    25687.     7163.         0.     37571.
11       0.    12983.     2143.         0.     21027.
12       0.     1309.        0.         0.     11810.
13       0.        0.      635.         0.         0.
```

CHECK.DAT

This output of IMPACN.FOR contains the transactions table corresponding to changes made by the user during the operation of IMPACN.FOR.

NEW TRANSACTIONS TABLE
PAGE 1

THOUSANDS OF DOLLARS

INDUSTRY	HARD-ROCK MINING	PLACER MINING	OIL AND GAS	FORESTRY	FISHING, HUNTING, TRAPPING AND SUBSISTENCE	TRANS-PORTATION	CONSTRUCTION
HARD-ROCK MINING	0.	0.	0.	0.	0.	0.	0.
PLACER MINING	0.	0.	0.	0.	0.	0.	0.
OIL AND GAS	0.	0.	0.	0.	0.	0.	0.
FORESTRY	170.	0.	0.	0.	0.	0.	182.
FISHING, HUNTING, TRAPPING AND SUBSISTENCE	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION	14193.	160.	6.	80.	0.	1[illegible]03.	8516.
CONSTRUCTION	584.	46.	1.	130.	0.	11740.	19001.
UTILITIES	7177.	5.	0.	5.	0.	[illegible]81.	619.
WHOLESALE TRADE	2584.	337.	2.	3.	0.	2[illegible]68.	2345.
RETAIL TRADE	56.	29.	1.	0.	1032.	[illegible]578.	1155.
SERVICES	9304.	234.	0.	0.	0.	[illegible]265.	2799.
FINANCE, INSURANCE AND REAL ESTATE	36.	38.	0.	0.	0.	[illegible]280.	3925.
MANUFACTURING	9403.	8.	0.	0.	0.	93.	28.
TOTAL PROCESSING	43507.	857.	10.	218.	1032.	2[illegible]408.	38570.

	HARD-ROCK MINING	PLACER MINING	OIL AND GAS	FORESTRY	FISHING, HUNTING, TRAPPING AND SUBSISTENCE	TRANS-PORTATION	CONSTRUCTION
INDIRECT TAXES LESS SUBSIDIES	840.	0.	7.	76.	4.	1746.	3004.
OTHER OPERATING SURPLUS	35234.	0.	-193.	-9168.	0.	-23254.	7573.
DEPRECIATION	13096.	0.	0.	21.	0.	35360.	4584.
NET INCOME OF UNINCORPORATED BUSINESS	0.	623.	0.	10.	3594.	0.	657.
LABOUR INCOME	37053.	674.	220.	1095.	0.	13460.	21553.
IMPORTS	20863.	862.	13.	13.	0.	6240.	5576.
TOTAL FINAL PAYMENTS	107086.	2109.	47.	1847.	3598.	33552.	42947.
TOTAL OUTLAYS	150593.	2966.	57.	2065.	4630.	57961.	81516.

NEW TRANSACTIONS TABLE
PAGE 2

THOUSANDS OF DOLLARS

INDUSTRY	UTILITIES	WHOLESALE TRADE	RETAIL TRADE	SERVICES	FINANCE, INSURANCE AND REAL ESTATE	MANUFAC-TURING	TOTAL INTERMEDIATE PRODUCTION
HARD-ROCK MINING	0.	0.	0.	0.	0.	0.	0.
PLACER MINING	0.	859.	0.	0.	0.	860.	1719.
OIL AND GAS	0.	0.	0.	0.	0.	0.	0.
FORESTRY	0.	0.	0.	0.	0.	1594.	1946.
FISHING, HUNTING, TRAPPING AND SUBSISTENCE	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION	2711.	17047.	9179.	1775.	26.	284.	55381.
CONSTRUCTION	4114.	13359.	15384.	434.	3020.	4.	67817.
UTILITIES	787.	743.	1115.	1053.	929.	268.	13382.
WHOLESALE TRADE	209.	2591.	7851.	1766.	1862.	89.	22008.
RETAIL TRADE	0.	81.	179.	1757.	123.	515.	6506.
SERVICES	3287.	1399.	8085.	5695.	113.	89.	34270.
FINANCE, INSURANCE AND REAL ESTATE	3087.	4221.	8281.	7179.	3280.	409.	33736.
MANUFACTURING	186.	34.	1045.	59.	18.	49.	10923.
TOTAL PROCESSING	14381.	40334.	51119.	19718.	9370.	4161.	247686.

	UTILITIES	WHOLESALE TRADE	RETAIL TRADE	SERVICES	FINANCE, INSURANCE AND REAL ESTATE	MANUFAC-TURING	TOTAL INTERMEDIATE PRODUCTION
INDIRECT TAXES LESS SUBSIDIES	-2.	1.	211.	2332.	3877.	43.	12139.
OTHER OPERATING SURPLUS	0.	1982.	2376.	13085.	28968.	2137.	58689.
DEPRECIATION	0.	121.	141.	4636.	180.	196.	68135.
NET INCOME OF UNINCORPORATED BUSINESS	210.	98.	914.	3053.	556.	46.	9761.
LABOUR INCOME	2479.	11059.	13063.	23745.	3515.	1330.	129996.
IMPORTS	4463.	17859.	8372.	3853.	388.	3645.	72147.
TOTAL FINAL PAYMENTS	7150.	31120.	25827.	50704.	37484.	7397.	350869.
TOTAL OUTLAYS	21531.	71454.	76947.	70423.	46854.	11558.	598554.

NEW TRANSACTIONS TABLE
PAGE 3

THOUSANDS OF DOLLARS

INDUSTRY	VALUE OF PHYSICAL CHANGE IN INVENTORIES	EXPORTS	GOVERNMENT	GROSS FIXED CAPITAL FORMATION	CONSUMPTION	GDP	TOTAL GROSS OUTPUT
HARD-ROCK MINING	17378.	133213.	0.	0.	0.	150591.	150591.
PLACER MINING	0.	1247.	0.	0.	0.	1247.	2966.
OIL AND GAS	0.	57.	0.	0.	0.	57.	57.
FORESTRY	0.	0.	119.	0.	0.	119.	2065.
FISHING, HUNTING, TRAPPING AND SUBSISTENCE	0.	934.	0.	0.	3696.	4630.	4630.
TRANSPORTATION	0.	0.	2580.	0.	0.	2580.	57961.
CONSTRUCTION	0.	0.	2302.	11398.	0.	13700.	81517.
UTILITIES	0.	724.	238.	0.	7187.	8149.	21531.
WHOLESALE TRADE	0.	0.	24486.	24961.	0.	49447.	71455.
RETAIL TRADE	0.	25687.	7183.	0.	37571.	70441.	76947.
SERVICES	0.	12983.	2143.	0.	21027.	36153.	70423.
FINANCE, INSURANCE AND REAL ESTATE	0.	1309.	0.	0.	11810.	13119.	46855.
MANUFACTURING	0.	0.	635.	0.	0.	635.	11558.
TOTAL PROCESSING	17378.	176154.	39686.	36359.	81291.	350868.	598554.

	VALUE OF PHYSICAL CHANGE IN INVENTORIES	EXPORTS	GOVERNMENT	GROSS FIXED CAPITAL FORMATION	CONSUMPTION	GDP	TOTAL GROSS OUTPUT
INDIRECT TAXES LESS SUBSIDIES	0.	0.	0.	0.	0.	0.	12139.
OTHER OPERATING SURPLUS	0.	0.	0.	0.	0.	0.	58689.
DEPRECIATION	0.	0.	9861.	0.	3240.	13101.	81236.
NET INCOME OF UNINCORPORATED BUSINESS	0.	0.	0.	0.	7047.	7047.	16808.
LABOUR INCOME	0.	0.	50226.	0.	0.	50226.	100222.
IMPORTS	225.	0.	6969.	78244.	7181.	92619.	164766.
TOTAL FINAL PAYMENTS	225.	0.	67056.	78244.	17468.	162993.	513862.
TOTAL OUTLAYS	17603.	176154.	106742.	114603.	98759.	513861.	1112415.

YUKON

Program:	PHYSIN.FOR
Inputs:	PHYSIN.IN1 PHYSIN.IN2 IMPACT.OUT
Output:	PHYSIN.OUT

PHYSIN.FOR

This program calculates physical input requirements necessary to support levels of final demand that are read as inputs.

```
C
C     GIVEN A SET OF GROSS OUTPUTS, THIS PROGRAM CALCULATES THE
C     PHYSICAL INPUT REQUIREMENTS NECESSARY TO SUPPORT THE ASSOCIATED
C     LEVELS OF FINAL DEMAND.
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     FINAL=FINAL DEMAND BY INDUSTRY AND FINAL DEMAND CATEGORY
C     NEWOUT=NEW GROSS OUTPUTS BY INDUSTRY
C     NEWPI=NEW PHYSICAL INPUT REQUIREMENTS IMPLIED BY THE NEW GROSS
C        OUTPUTS BY INDUSTRY
C     OUTPUT=1978 GROSS OUTPUT BY INDUSTRY
C     PI=1978 PHYSICAL INPUT REQUIREMENTS BY INDUSTRY
C     PIPDGO=1978 PHYSICAL INPUT REQUIREMENTS PER DOLLAR 1978 GROSS
C        OUTPUT BY INDUSTRY
C     TITLE=TITLE OF PHYSICAL INPUT REQUIREMENT
C     UNIT=UNITS OF MEASUREMENT OF PHYSICAL INPUT REQUIREMENT
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER FOR INDUSTRY; I=1,2,...,NI
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;
C        13=MANUFACTURING; 14=HOUSEHOLDS
C     J=COUNTER FOR FINAL DEMAND CATEGORY; J=1,2,...,5
C     FINAL DEMAND CATEGORIES:  1=INVENTORIES; 2=EXPORTS; 3=GOVERNMENT;
C        4=GROSS FIXED CAPITAL FORMATION; 5= CONSUMPTION
C     NI=NUMBER OF INDUSTRIES
C
      REAL*8 FINAL(13,5)
      REAL*8 NEWOUT(13)
      REAL*8 NEWPI(13)
      REAL*8 OUTPUT(13)
      REAL*8 PI(13)
      REAL*8 PIPDGO(13)
      REAL*8 TITLE
      REAL*8 UNIT
C
      INTEGER I, J, NI
C
      DATA FINAL /65*0D0/
      DATA NEWOUT /13*0D0/
      DATA NEWPI /13*0D0/
      DATA OUTPUT /13*0D0/
      DATA PI /13*0D0/
      DATA PIPDGO /13*0D0/
```

```
C
      OPEN(UNIT=8,DEVICE='DSK',FILE='PHYSIN.IN1')
      OPEN(UNIT=9,DEVICE='DSK',FILE='PHYSIN.IN2')
      OPEN(UNIT=10,DEVICE='DSK',FILE='PHYSIN.OUT')
      OPEN(UNIT=11,DEVICE='DSK',FILE='IMPACT.OUT')
C
C     INPUT ROUTINE
C
      NI=13
 
      READ(8,1) TITLE
1     FORMAT(A10)
      READ(8,7) UNIT
7     FORMAT(A3)
      READ(8,2)(PI(I),I=1,NI)
2     FORMAT(3X,8F9.0/3X,5F9.0)
      READ(9,3)(OUTPUT(I),I=1,NI)
3     FORMAT(3X,8F9.0/3X,5F9.0)
      READ(11,4)(NEWOUT(I),I=1,NI)
4     FORMAT(3X,8F9.1/3X,5F9.1)
      DO 5 I=1,NI
5     READ(11,6)(FINAL(I,J),J=1,5)
6     FORMAT(3X,5F9.1)
C
C     CALCULATION ROUTINE
C
      DO 12 I=1,NI
      OUTPUT(I)=OUTPUT(I)*1000.
12    NEWOUT(I)=NEWOUT(I)*1000.
      DO 10 I=1,NI
10    PIPDGO(I)=PI(I)/OUTPUT(I)
      DO 11 I=1,NI
11    NEWPI(I)=PIPDGO(I)*NEWOUT(I)
      DO 13 I=1,NI
13    NEWOUT(I)=NEWOUT(I)/1000.
C
C     OUTPUT ROUTINE
C
      WRITE(10,50)
50    FORMAT('1',51X,'PHYSICAL INPUT REQUIREMENTS')
      WRITE(10,51) TITLE
51    FORMAT('0',74X,'GROSS FIXED',35X,A10)
      WRITE(10,52)
52    FORMAT(' ',76X,'CAPITAL',24X,'GROSS',10X,'INPUT')
      WRITE(10,53)
53    FORMAT(' INDUSTRY',21X,'INVENTORIES',6X,'EXPORTS',7X,'GOVERNMENT',
     1 5X,'FORMATION',5X,'CONSUMPTION',7X,'OUTPUT',6X,'REQUIREMENT')
      WRITE(10,54) UNIT
54    FORMAT(' ',23X,6(8X,'($''000)'),9X,'(',A3,')')
      WRITE(10,60) (FINAL(1,J),J=1,5), NEWOUT(1), NEWPI(1)
60    FORMAT('-HARD-ROCK MINING',6X,7F15.1)
      WRITE(10,61) (FINAL(2,J),J=1,5), NEWOUT(2), NEWPI(2)
61    FORMAT('-PLACER MINING',9X,7F15.1)
      WRITE(10,62) (FINAL(3,J),J=1,5), NEWOUT(3), NEWPI(3)
62    FORMAT('-OIL AND GAS',11X,7F15.1)
      WRITE(10,64) (FINAL(4,J),J=1,5), NEWOUT(4), NEWPI(4)
64    FORMAT('-FORESTRY',14X,7F15.1)
```

```
      WRITE(10,63)
63    FORMAT('0FISHING, HUNTING, TRAPPING')
      WRITE(10,65) (FINAL(5,J),J=1,5), NEWOUT(5), NEWPI(5)
65    FORMAT(' AND SUBSISTENCE',7X,7F15.1)
      WRITE(10,66) (FINAL(6,J),J=1,5), NEWOUT(6), NEWPI(6)
66    FORMAT('-TRANSPORTATION',8X,7F15.1)
      WRITE(10,67) (FINAL(7,J),J=1,5), NEWOUT(7), NEWPI(7)
67    FORMAT('-CONSTRUCTION',10X,7F15.1)
      WRITE(10,68) (FINAL(8,J),J=1,5), NEWOUT(8), NEWPI(8)
68    FORMAT('-UTILITIES',13X,7F15.1)
      WRITE(10,69) (FINAL(9,J),J=1,5), NEWOUT(9), NEWPI(9)
69    FORMAT('-WHOLESALE TRADE',7X,7F15.1)
      WRITE(10,70) (FINAL(10,J),J=1,5), NEWOUT(10), NEWPI(10)




70    FORMAT('-RETAIL TRADE',10X,7F15.1)
      WRITE(10,72) (FINAL(11,J),J=1,5), NEWOUT(11), NEWPI(11)
72    FORMAT('-SERVICES',14X,7F15.1)
      WRITE(10,71)
71    FORMAT('0FINANCE, INSURANCE')
      WRITE(10,73) (FINAL(12,J),J=1,5), NEWOUT(12), NEWPI(12)
73    FORMAT(' AND REAL ESTATE',7X,7F15.1)
      WRITE(10,74) (FINAL(13,J),J=1,5), NEWOUT(13), NEWPI(13)
74    FORMAT('-MANUFACTURING',9X,7F15.1)
      WRITE(10,75)
75    FORMAT('1')
      STOP
      END
```

PHYSIN.IN1

This input file contains information on specified input requirements in a base year by industries 1 to 13.

```
ELECTRICAL
KWH
     101040.      500.       100.   10000.      150.       110.      3000.      1000.
       1500.     5000.     15000.     900.     1000.
```

PHYSIN.IN2

This input file contains base year gross outlays by industry.

```
150593.     2966.       57.     2065.     4630.   57961.   81516.  21531.
 71454.    76947.    70423.    46854.    11558.
```

IMPACT.OUT

This output of IMPACN.FOR contains total outlays of industry 1 to 13 and final demand values of 5 sectors for output of industries 1 to 13.

```
                                          e
NO  150591.      2966.        57.      2065.      4630.     57961.     81517.     21531.
     71455.     76947.     70423.     46855.     11558.
  1  17378.    133213.         0.         0.         0.
  2      0.      1247.         0.         0.         0.
  3      0.        57.         0.         0.         0.
  4      0.         0.       119.         0.         0.
  5      0.       934.         0.         0.      3696.
  6      0.         0.      2580.         0.         0.
  7      0.         0.      2302.     11398.         0.
  8      0.       724.       238.         0.      7187.
  9      0.         0.     24486.     24961.         0.
 10      0.     25687.      7183.         0.     37571.
 11      0.     12983.      2143.         0.     21027.
 12      0.      1309.         0.         0.     11810.
 13      0.         0.       635.         0.         0.
```

PHYSIN.OUT

Output of PHYSIN.FOR shows physical input requirements by industry.

PHYSICAL INPUT REQUIREMENTS

INDUSTRY	INVENTORIES ($'000)	EXPORTS ($'000)	GOVERNMENT ($'000)	GROSS FIXED CAPITAL FORMATION ($'000)	CONSUMPTION ($'000)	GROSS OUTPUT ($'000)	ELECTRICAL INPUT REQUIREMENT (KWH)
HARD-ROCK MINING	17378.0	133213.0	0.0	0.0	0.0	150591.0	101038.7
PLACER MINING	.0.0	1247.0	0.0	0.0	0.0	2966.0	500.0
OIL AND GAS	0.0	57.0	0.0	0.0	0.0	57.0	100.0
FORESTRY	0.0	0.0	119.0	0.0	0.0	2065.0	10000.0
FISHING, HUNTING, TRAPPING AND SUBSISTENCE	0.0	934.0	0.0	0.0	3696.0	4630.0	150.0
TRANSPORTATION	0.0	0.0	2580.0	0.0	0.0	57961.0	110.0
CONSTRUCTION	0.0	0.0	2302.0	11398.0	0.0	81517.0	3000.0
UTILITIES	0.0	724.0	238.0	0.0	7187.0	21531.0	1000.0
WHOLESALE TRADE	0.0	0.0	24486.0	24961.0	0.0	71455.0	1500.0
RETAIL TRADE	0.0	25687.0	7183.0	0.0	37571.0	76947.0	5000.0
SERVICES	0.0	12983.0	2143.0	0.0	21027.0	70423.0	15000.0
FINANCE, INSURANCE AND REAL ESTATE	0.0	1309.0	0.0	0.0	11810.0	46855.0	900.0
MANUFACTURING	0.0	0.0	635.0	0.0	0.0	11558.0	1000.0

YRB

Program: INV.FOR
Input : YRB.COE
Output : INV.OUT

INV.FOR

This program calculates the direct plus indirect requirements matrix by inverting a matrix that is the result of subtracting the direct requirements matrix from the indentity matrix.

```
C
C     GIVEN A DIRECT REQUIREMENTS MATRIX, THIS PROGRAM CALCULATES THE
C     INVERSE OF THE IDENTITY MATRIX MINUS THE DIRECT REQUIREMENTS
C     MATRIX.  THIS CALCULATION IS PERFORMED BOTH IN AN OPEN SYSTEM
C     AND IN A CLOSED SYSTEM (IN WHICH A ROW AND COLUMN REPRESENTING
C     HOUSEHOLDS ARE INCLUDED IN THE DIRECT REQUIREMENTS MATRIX).
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     A=DIRECT REQUIREMENTS MATRIX BY INDUSTRY AND INDUSTRY
C     AH=DIRECT REQUIREMENTS MATRIX WITH THE HOUSEHOLD ROW AND COLUMN
C        INCLUDED BY INDUSTRY AND INDUSTRY
C     AJI=TEMPORARY STORAGE USED IN THE MATRIX INVERSION ROUTINE
C     HC=HOUSEHOLD COEFFICIENT COLUMN (PERSONAL EXPENDITURE) BY
C        INDUSTRY
C     HR=HOUSEHOLD COEFFICIENT ROW (WAGES, SALARIES AND SUPPLEMENTARY
C        LABOUR INCOME) BY INDUSTRY
C     IAHINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX INCLUDING THE HOUSEHOLD ROW AND COLUMN BY INDUSTRY
C        AND INDUSTRY
C     IAINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX BY INDUSTRY AND INDUSTRY
C     PIVOT=TEMPORARY STORAGE USED IN THE MATRIX INVERSION ROUTINE
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER FOR INDUSTRY; I=1,2,...,NIP1
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;
C        13=MANUFACTURING; 14=HOUSEHOLDS
C     J=COUNTER FOR INDUSTRY; J=1,2,...,NIP1
C     K=COUNTER FOR INDUSTRY; K=1,2,...,NIP1
C     NI=NUMBER OF INDUSTRIES
C     NIP1=NUMBER OR INDUSTRIES PLUS ONE (REPRESENTING HOUSEHOLDS)
C
      REAL*8 A(13,13)
      REAL*8 AH(14,14)
      REAL*8 AJI
      REAL*8 HC(14)
      REAL*8 HR(14)
      REAL*8 IAHINV(14,14)
      REAL*8 IAINV(13,13)
      REAL*8 PIVOT
C
      INTEGER I, J, K, NI, NIP1
C
```

```
      DATA A /169*0D0/
      DATA AH /196*0D0/
      DATA AJI /0D0/
      DATA HC /14*0D0/
      DATA HR /14*0D0/
      DATA IAHINV /196*0D0/
      DATA IAINV /169*0D0/
      DATA PIVOT /0D0/
C
      OPEN(UNIT=8,DEVICE='DSK',FILE='YRB.COE')
      OPEN(UNIT=10,DEVICE='DSK',FILE='INV.OUT')
C
C     INPUT ROUTINE
C
      NI=13
      NIP1=NI+1
      DO 1 I=1,NI
 1    READ(8,2)(A(I,J),J=1,NI)
 2    FORMAT(3X,8F9.6/3X,5F9.6)
      READ(8,3)(HC(I),I=1,NIP1)
 3    FORMAT(' HC',8F9.6/3X,6F9.6)
      READ(8,4)(HR(I),I=1,NIP1)
 4    FORMAT(' HR',8F9.6/3X,6F9.6)
C
C     CALCULATION OF A, AH, I-A AND I-AH
C
      DO 10 I=1,NI
      DO 10 J=1,NI
 10   AH(I,J)=A(I,J)
      DO 11 I=1,NI
 11   AH(I,NIP1)=HC(I)
      DO 12 J=1,NIP1
 12   AH(NIP1,J)=HR(J)
      DO 13 I=1,NI
 13   IAINV(I,I)=1.0-A(I,I)
      DO 14 I=1,NI
      DO 14 J=1,NI
      IF (I.EQ.J) GO TO 14
      IAINV(I,J)=-A(I,J)
 14   CONTINUE
      DO 15 I=1,NIP1
 15   IAHINV(I,I)=1.0-AH(I,I)
      DO 16 J=1,NIP1
      DO 16 I=1,NIP1
      IF (I.EQ.J) GO TO 16
      IAHINV(I,J)=-AH(I,J)
 16   CONTINUE
C
C     CALCULATION OF THE INVERSE OF I-A AND I-AH
C
      DO 20 I=1,NI
      PIVOT=IAINV(I,I)
      IAINV(I,I)=1.0
      DO 21 K=1,NI
 21   IAINV(I,K)=IAINV(I,K)/PIVOT
```

```
      DO 22 J=1,NI
      IF (J-I) 23,22,23
23    AJI=IAINV(J,I)
      IAINV(J,I)=0.0
      DO 24 K=1,NI
24    IAINV(J,K)=IAINV(J,K)-IAINV(I,K)*AJI
22    CONTINUE
20    CONTINUE
      DO 30 I=1,NIP1
      PIVOT=IAHINV(I,I)
      IAHINV(I,I)=1.0
      DO 31 K=1,NIP1
31    IAHINV(I,K)=IAHINV(I,K)/PIVOT
      DO 32 J=1,NIP1

      IF (J-I) 33,32,33
33    AJI=IAHINV(J,I)
      IAHINV(J,I)=0.0
      DO 34 K=1,NIP1
34    IAHINV(J,K)=IAHINV(J,K)-IAHINV(I,K)*AJI
32    CONTINUE
30    CONTINUE
C
C     OUTPUT ROUTINE
C
      DO 40 I=1,NI
40    WRITE(10,41) I,(A(I,J),J=1,NI)
41    FORMAT(I3,8F9.6/3X,5F9.6)
      WRITE(10,43)(HR(I),I=1,NIP1)
43    FORMAT(' HR',8F9.6/3X,6F9.6)
      WRITE(10,45)(HC(I),I=1,NIP1)
45    FORMAT(' HC',8F9.6/3X,6F9.6)
      DO 46 I=1,NI
46    WRITE(10,41) I,(IAINV(I,J),J=1,NI)
      DO 47 I=1,NIP1
47    WRITE(10,48) I,(IAHINV(I,J),J=1,NIP1)
48    FORMAT(I3,8F9.6/3X,6F9.6)
      STOP
      END
```

YRB.COE

This data set consists of the direct requirements matrix derived from the 1978 transactions table. It is the input used by the preceding INV.FOR program.

```
  1    .00000    .00000    .00000    .00000    .00000    .00000    .00000    .00000
       .00000    .00000    .00000    .00000    .00000
  2    .00000    .00000    .00000    .00000    .00000    .00000    .00000    .00000
       .01202    .00000    .00000    .00000    .11947
  3    .00000    .00000    .00000    .00000    .00000    .00000    .00000    .00000
       .00000    .00000    .00000    .00000    .00000
  4    .00113    .00000    .00000    .00000    .00000    .00000    .00000    .00000
       .00000    .00000    .00000    .00000    .00353
  5    .00000    .00000    .00000    .00000    .00000    .00000    .00000    .00000
       .00000    .00000    .00000    .00000    .00000
  6    .09425    .05394    .00000    .03865    .00000    .02424    .10463    .12590
       .23858    .11928    .07521    .00055    .03945
  7    .00388    .01551    .00000    .06280    .00000    .20280    .23342    .19106
       .18696    .19993    .00616    .06444    .00057
  8    .04766    .00169    .00000    .02415    .00000    .01176    .00761    .03657
       .01040    .01449    .01494    .01984    .03716
  9    .01716    .11367    .00000    .01449    .00000    .04091    .02881    .00971
       .03625    .10203    .07508    .03975    .01230
 10    .00037    .00978    .00000    .00000    .22289    .02726    .01419    .00000
       .00113    .00232    .02495    .00263    .07154
 11    .06178    .07889    .00000    .00000    .00000    .05639    .03439    .15267
       .01958    .10508    .08087    .00241    .01230
 12    .00024    .01281    .00000    .00000    .00000    .05667    .04822    .14335
       .05907    .10762    .10193    .07001    .05684
 13    .03403    .00270    .00000    .00000    .00000    .00160    .00034    .00863
       .00048    .01358    .00084    .00039    .00679
 HC    .00000    .00000    .00000    .00000    .04133    .00000    .00000    .07386
       .00000    .36130    .21867    .12797    .00000    .00000
 HR    .14969    .12812    .00000    .32367    .00000    .23191    .16080    .07001
       .09416    .10960    .20513    .04563    .06998    .00000
```

INV.OUT

The direct plus indirect requirements matrices appear on the following pages for both the closed economy and the open economy. The closed system is distinguished from the open system in that the household sector (Consumption column and Labour Income row) becomes part of the Inter-industry matrix.

```
 1 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.012020 0.000000 0.000000 0.000000 0.119470
 3 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001130 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.003530
 5 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.094250 0.053940 0.000000 0.038650 0.000000 0.024240 0.104630 0.125900
   0.238580 0.119280 0.025210 0.000550 0.039450
 7 0.003880 0.015510 0.000000 0.062800 0.000000 0.202800 0.233420 0.191060
   0.186960 0.199930 0.006160 0.064440 0.000570
 8 0.047660 0.001690 0.000000 0.024150 0.000000 0.011760 0.007610 0.036570
   0.010400 0.014490 0.014940 0.019840 0.037180
 9 0.017160 0.113620 0.000000 0.014490 0.000000 0.040910 0.028810 0.009710
   0.036250 0.102030 0.025080 0.039750 0.012300
10 0.000370 0.009780 0.000000 0.000000 0.222890 0.027260 0.014190 0.000000
   0.001130 0.002320 0.024950 0.002630 0.071540
11 0.061780 0.078890 0.000000 0.000000 0.000000 0.056390 0.034390 0.152670
   0.019580 0.105080 0.080870 0.002410 0.012300
12 0.000240 0.012810 0.000000 0.000000 0.000000 0.056670 0.048220 0.143350
   0.059070 0.107620 0.101930 0.070010 0.056840
13 0.034030 0.002700 0.000000 0.000000 0.000000 0.001600 0.000340 0.008630
   0.000480 0.013580 0.000840 0.000390 0.006790
HR 0.149690 0.128120 0.000000 0.323670 0.000000 0.231910 0.160800 0.070010
   0.094160 0.109600 0.205130 0.045630 0.069980 0.000000
HC 0.000000 0.000000 0.000000 0.000000 0.041330 0.000000 0.000000 0.073860
   0.000000 0.361300 0.218670 0.127970 0.000000 0.000000
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.004584 1.001989 0.000000 0.000329 0.000774 0.001126 0.000858 0.001753
   0.013084 0.003470 0.000707 0.000719 0.121100
 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001254 0.000012 0.000000 1.000002 0.000012 0.000010 0.000005 0.000036
   0.000006 0.000053 0.000006 0.000003 0.003561
 5 0.000000 0.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.123681 0.103302 0.000000 0.061754 0.046379 1.086090 0.169855 0.192179
   0.308378 0.208079 0.051568 0.030450 0.084264
 7 0.065632 0.091042 0.000000 0.113254 0.084434 0.328028 1.383586 0.348626
   0.363532 0.378816 0.057551 0.120293 0.077612
 8 0.055480 0.008114 0.000000 0.027603 0.006475 0.020764 0.017200 1.051870
   0.021948 0.029049 0.021955 0.024740 0.045337
 9 0.031361 0.131787 0.000000 0.022829 0.031285 0.066838 0.057572 0.045628
   1.071647 0.140361 0.041748 0.051332 0.047165
10 0.009612 0.017010 0.000000 0.003746 0.227113 0.037109 0.026496 0.016664
   0.016932 1.018947 0.030317 0.005930 0.078491
11 0.089198 0.102017 0.000000 0.013606 0.033928 0.088430 0.069654 0.203292
   0.062387 0.152219 1.101746 0.015189 0.049732
12 0.034846 0.047796 0.000000 0.017297 0.040404 0.104803 0.099194 0.219672
   0.118172 0.181272 0.136540 1.092860 0.097008
13 0.035215 0.003393 0.000000 0.000460 0.003327 0.002701 0.001387 0.010081
   0.001696 0.014926 0.001716 0.000855 1.008898
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.005035 1.002410 0.000000 0.001075 0.000900 0.001822 0.001452 0.002230
   0.013604 0.004038 0.001244 0.000897 0.121407 0.002048



 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001261 0.000018 0.000000 1.000012 0.000014 0.000020 0.000013 0.000042
   0.000013 0.000061 0.000014 0.000006 0.003566 0.000029
 5 0.011211 0.010447 0.000000 0.018554 1.003145 0.017298 0.014789 0.011868
   0.012947 0.014111 0.013365 0.004418 0.007645 0.050922
 6 0.152561 0.130213 0.000000 0.109547 0.054480 1.130648 0.207951 0.222750
   0.341730 0.244427 0.085994 0.041830 0.103958 0.131173
 7 0.118280 0.140103 0.000000 0.200381 0.099204 0.409259 1.453035 0.404357
   0.424332 0.445079 0.120310 0.141039 0.113515 0.239130
 8 0.081635 0.032487 0.000000 0.070888 0.013812 0.061120 0.051702 1.079557
   0.052154 0.061968 0.053134 0.035047 0.063173 0.118800
 9 0.050641 0.149753 0.000000 0.054735 0.036694 0.096585 0.083004 0.066037
   1.093912 0.164627 0.064731 0.058929 0.060313 0.087569
10 0.114359 0.114620 0.000000 0.177095 0.256498 0.198727 0.164672 0.127547
   0.137901 1.150783 0.155183 0.047206 0.149923 0.475775
11 0.174449 0.181459 0.000000 0.154689 0.057844 0.219966 0.182111 0.293536
   0.160840 0.259517 1.203371 0.048782 0.107868 0.387219
12 0.103501 0.111773 0.000000 0.130917 0.059664 0.210734 0.189761 0.292349
   0.197460 0.267683 0.218383 1.119914 0.143827 0.311842
13 0.037048 0.005102 0.000000 0.003494 0.003841 0.005530 0.003806 0.012022
   0.003814 0.017234 0.003901 0.001578 1.010148 0.008328
14 0.271260 0.252778 0.000000 0.448914 0.076097 0.418535 0.357829 0.287149
   0.313269 0.341411 0.323361 0.106891 0.184984 1.232094
```

YRB

Program: MULT.FOR
Input: INV.OUT
Output: MULT.OUT

MULT.FOR

This program calculates Type I and Type II multipliers from the direct plus indirect requirements matrices. Type I multipliers show the direct plus indirect changes in income resulting from an increase of $1.00 in the output of all the processing sectors. The Type II multiplier shows the direct plus indirect effects plus induced changes in income resulting from $1.00 incresase in Final Demand (excluding Households).

```
C
C     GIVEN A DIRECT REQUIREMENTS MATRIX, THIS PROGRAM CALCULATES BOTH
C     TYPE I AND TYPE II MULTIPLIERS FOR EACH INDUSTRY.
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     A=DIRECT REQUIREMENTS MATRIX BY INDUSTRY AND INDUSTRY
C     AH=DIRECT REQUIREMENTS MATRIX WITH HOUSEHOLD ROW AND COLUMN
C        INCLUDED BY INDUSTRY AND INDUSTRY
C     DCHG=DIRECT INCOME CHANGE BY INDUSTRY
C     DICHG=DIRECT AND INDIRECT INCOME CHANGE BY INDUSTRY
C     DIICHG=DIRECT, INDIRECT AND INDUCED INCOME CHANGE BY INDUSTRY
C     HC=HOUSEHOLD COEFFICIENTS COLUMN (PERSONAL EXPENDITURE) BY
C        INDUSTRY
C     HR=HOUSEHOLD COEFFICIENTS ROW (WAGES, SALARIES AND SUPPLEMENTARY
C        LABOUR INCOME) BY INDUSTRY
C     IAHINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX INCLUDING THE HOUSEHOLD ROW AND COLUMN BY INDUSTRY AND
C        INDUSTRY
C     IAINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX BY INDUSTRY AND INDUSTRY
C     ICCHG=INDUCED INCOME CHANGE BY INDUSTRY
C     IICHG=INDIRECT AND INDUCED INCOME CHANGE BY INDUSTRY
C     IRCHG=INDIRECT INCOME CHANGE BY INDUSTRY
C     MULTI=TYPE I MULTIPLIER BY INDUSTRY
C     MULTII=TYPE II MULTIPLIER BY INDUSTRY
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER FOR INDUSTRY; I=1,2,...,NIP1
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;
C        13=MANUFACTURING; 14=HOUSEHOLDS
C     J=COUNTER FOR INDUSTRY; J=1,2,...,NIP1
C     NI=NUMBER OF INDUSTRIES
C     NIP1=NUMBER OF INDUSTRIES PLUS ONE (REPRESENTING HOUSEHOLDS)
C
      REAL*8 A(13,13)
      REAL*8 AH(14,14)
      REAL*8 DCHG(13)
      REAL*8 DICHG(13)
      REAL*8 DIICHG(13)
      REAL*8 HC(14)
      REAL*8 HR(14)
      REAL*8 IAHINV(14,14)
      REAL*8 IAINV(13,13)
      REAL*8 ICCHG(13)
      REAL*8 IICHG(13)
      REAL*8 IRCHG(13)
      REAL*8 MULTI(13)
      REAL*8 MULTII(13)
```

```
C
      INTEGER I, J, NI, NIP1
C
      DATA A /169*0D0/
      DATA AH /196*0D0/
      DATA DCHG /13*0D0/
      DATA DICHG /13*0D0/
      DATA DIICHG /13*0D0/
      DATA HC /14*0D0/
      DATA HR /14*0D0/
      DATA IAHINV /196*0D0/
      DATA IAINV /169*0D0/
      DATA ICCHG /13*0D0/
      DATA IICHG /13*0D0/
      DATA IRCHG /13*0D0/
      DATA MULTI /13*0D0/
      DATA MULTII /13*0D0/
C
      OPEN(UNIT=8,DEVICE='DSK',FILE='INV.OUT')
      OPEN(UNIT=10,DEVICE='DSK',FILE='MULT.OUT')
C
C     INPUT ROUTINE
C
      NI=13
      NIP1=NI+1
      DO 1 I=1,NI
1     READ(8,2)(A(I,J),J=1,NI)
2     FORMAT(3X,8F9.6/3X,5F9.6)
      READ(8,3)(HR(I),I=1,NIP1)
3     FORMAT(3X,8F9.6/3X,6F9.6)
      READ(8,3)(HC(I),I=1,NIP1)
      DO 4 I=1,NI
4     READ(8,2)(IAINV(I,J),J=1,NI)
      DO 5 I=1,NIP1
5     READ(8,3)(IAHINV(I,J),J=1,NIP1)
C
C     CALCULATION OF AH, DCHG, DICHG, IRCHG AND MULTI
C
      DO 10 I=1,NI
      DO 10 J=1,NI
10    AH(I,J)=A(I,J)
      DO 11 I=1,NI
11    AH(I,NIP1)=HC(I)
      DO 12 J=1,NIP1
12    AH(NIP1,J)=HR(J)
      DO 13 J=1,NI
13    DCHG(J)=AH(NIP1,J)
      DO 14 I=1,NI
      DO 14 J=1,NI
14    DICHG(J)=DICHG(J)+IAINV(I,J)*AH(NIP1,I)
      DO 15 J=1,NI
15    IRCHG(J)=DICHG(J)-DCHG(J)
      DO 16 J=1,NI
16    MULTI(J)=DICHG(J)/DCHG(J)
C
```

```
C     CALCULATION OF DIICHG, ICCHG, IICHG AND MULTII
C
      DO 20 J=1,NI
 20   DIICHG(J)=TAHINV(NIP1,J)
      DO 21 J=1,NI
 21   ICCHG(J)=DIICHG(J)-DICHG(J)
      DO 22 J=1,NI
 22   IICHG(J)=IRCHG(J)+ICCHG(J)
      DO 23 J=1,NI
 23   MULTII(J)=DIICHG(J)/DCHG(J)
C
C     OUTPUT ROUTINE
C
      WRITE(10,74)
 74   FORMAT('1',53X,'INCOME MULTIPLIERS')
      WRITE(10,50)
 50   FORMAT('0',79X,'DIRECT,')
      WRITE(10,51)
 51   FORMAT(' ',42X,'DIRECT AND',25X,'INDIRECT AND',12X,
     1 'INDIRECT AND')
      WRITE(10,52)
 52   FORMAT(' ',32X,'DIRECT',5X,'INDIRECT',4X,'INDIRECT',16X,'INDUCED',
     1 5X,'INDUCED',5X,'INDUCED')
      WRITE(10,53)
 53   FORMAT(' ',32X,3('INCOME',6X),'TYPE I',3(6X,'INCOME'),5X,
     1 'TYPE II')
      WRITE(10,54)
 54   FORMAT(' INDUSTRY',18X,3(6X,'CHANGE'),4X,'MULTIPLIER',4X,'CHANGE',
     1 2(6X,'CHANGE'),4X,'MULTIPLIER'/)
      WRITE(10,60) DCHG(1), DICHG(1), IRCHG(1), MULTI(1), DIICHG(1),
     1 ICCHG(1), IICHG(1), MULTII(1)
 60   FORMAT('-HARD-ROCK MINING',9X,8F12.2)
      WRITE(10,61) DCHG(2), DICHG(2), IRCHG(2), MULTI(2), DIICHG(2),
     1 ICCHG(2), IICHG(2), MULTII(2)
 61   FORMAT('-PLACER MINING',12X,8F12.2)
      WRITE(10,63) DCHG(4), DICHG(4), IRCHG(4), MULTI(4), DIICHG(4),
     1 ICCHG(4), IICHG(4), MULTII(4)
      WRITE(10,62) DCHG(3),DICHG(3),IRCHG(3),MULTI(3),DIICHG(3),
     1ICCHG(3),IICHG(3),MULTII(3)
   62 FORMAT('-OIL AND GAS',14X,8F12.2)
 63   FORMAT('-FORESTRY',17X,8F12.2)
      WRITE(10,66) DCHG(6), DICHG(6), IRCHG(6), MULTI(6), DIICHG(6),
     1 ICCHG(6), IICHG(6), MULTII(6)
 66   FORMAT('-TRANSPORTATION',11X,8F12.2)
      WRITE(10,67) DCHG(7), DICHG(7), IRCHG(7), MULTI(7), DIICHG(7),
     1 ICCHG(7), IICHG(7), MULTII(7)
 67   FORMAT('-CONSTRUCTION',13X,8F12.2)
      WRITE(10,68) DCHG(8), DICHG(8), IRCHG(8), MULTI(8), DIICHG(8),
     1 ICCHG(8), IICHG(8), MULTII(8)
 68   FORMAT('-UTILITIES',16X,8F12.2)
      WRITE(10,69) DCHG(9), DICHG(9), IRCHG(9), MULTI(9), DIICHG(9),
     1 ICCHG(9), IICHG(9), MULTII(9)
 69   FORMAT('-WHOLESALE TRADE',10X,8F12.2)
      WRITE(10,70) DCHG(10), DICHG(10), IRCHG(10), MULTI(10),
     1 DIICHG(10), ICCHG(10), IICHG(10), MULTII(10)
 70   FORMAT('-RETAIL TRADE',13X,8F12.2)
      WRITE(10,72) DCHG(11), DICHG(11), IRCHG(11), MULTI(11),
     1 DIICHG(11), ICCHG(11), IICHG(11), MULTII(11)
```

```
72    FORMAT('-SERVICES',17X,8F12.2)
      WRITE(10,71)
71    FORMAT('0FINANCE, INSURANCE')
      WRITE(10,73) DCHG(12), DICHG(12), IRCHG(12), MULTI(12),
     1 DIICHG(12), ICCHG(12), IICHG(12), MULTII(12)
73    FORMAT(' AND REAL ESTATE',10X,8F12.2)
      WRITE(10,76) DCHG(13), DICHG(13), IRCHG(13), MULTI(13),
     1 DIICHG(13), ICCHG(13), IICHG(13), MULTII(13)
76    FORMAT('-MANUFACTURING',12X,8F12.2)
      WRITE(10,75)
75    FORMAT('1')




      STOP
      END
```

INV.OUT

The first part of this data set is a duplicate of the direct requirements matrix YRB. COE. Following this are direct plus indirect requirements matrices for both the closed economy and the open economy. The closed system is distinguished from the open system in that the household sector (Consumption column and Labour Income row) becomes part of the inter-industry matrix.

```
 1 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.012020 0.000000 0.000000 0.000000 0.119470
 3 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001130 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.003530
 5 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.094250 0.053940 0.000000 0.038650 0.000000 0.024240 0.104630 0.125900
   0.238580 0.119280 0.025210 0.000550 0.039450
 7 0.003880 0.015510 0.000000 0.062800 0.000000 0.202800 0.233420 0.191060
   0.186960 0.199930 0.006160 0.064440 0.000570
 8 0.047660 0.001690 0.000000 0.024150 0.000000 0.011760 0.007610 0.036570
   0.010400 0.014490 0.014940 0.019840 0.037180
 9 0.017160 0.113620 0.000000 0.014490 0.000000 0.040910 0.028810 0.009710
   0.036250 0.102030 0.025080 0.039750 0.012300
10 0.000370 0.009780 0.000000 0.000000 0.222890 0.027260 0.014190 0.000000
   0.001130 0.002320 0.024950 0.002630 0.071540
11 0.061780 0.078890 0.000000 0.000000 0.000000 0.056390 0.034390 0.152670
   0.019580 0.105080 0.080870 0.002410 0.012300
12 0.000240 0.012810 0.000000 0.000000 0.000000 0.056670 0.048220 0.143350
   0.059070 0.107620 0.101930 0.070010 0.056840
13 0.034030 0.002700 0.000000 0.000000 0.000000 0.001600 0.000340 0.008630
   0.000480 0.013580 0.000840 0.000390 0.006790
HR 0.149690 0.128120 0.000000 0.323670 0.000000 0.231910 0.160800 0.070010
   0.094160 0.109600 0.205130 0.045630 0.069980 0.000000
HC 0.000000 0.000000 0.000000 0.000000 0.041330 0.000000 0.000000 0.073860
   0.000000 0.361300 0.218670 0.127970 0.000000 0.000000
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.004584 1.001989 0.000000 0.000329 0.000774 0.001126 0.000858 0.001753
   0.013084 0.003470 0.000707 0.000719 0.121100
 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001254 0.000012 0.000000 1.000002 0.000012 0.000010 0.000005 0.000036
   0.000006 0.000053 0.000006 0.000003 0.003561
 5 0.000000 0.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.123681 0.103302 0.000000 0.061754 0.046379 1.086090 0.169855 0.192179
   0.308378 0.208079 0.051568 0.030450 0.084264
 7 0.065632 0.091042 0.000000 0.113254 0.084434 0.328028 1.383586 0.348626
   0.363532 0.378816 0.057551 0.120293 0.077612
 8 0.055480 0.008114 0.000000 0.027603 0.006475 0.020764 0.017200 1.051870
   0.021948 0.029049 0.021955 0.024740 0.045337
 9 0.031361 0.131787 0.000000 0.022829 0.031285 0.066838 0.057572 0.045628
   1.071647 0.140361 0.041748 0.051332 0.047165
10 0.009612 0.017010 0.000000 0.003746 0.227113 0.037109 0.026496 0.016664
   0.016932 1.018947 0.030317 0.005930 0.078491
11 0.089198 0.102017 0.000000 0.013606 0.033928 0.088430 0.069654 0.203292
   0.062387 0.152219 1.101746 0.015189 0.049732
12 0.034846 0.047796 0.000000 0.017297 0.040404 0.104803 0.099194 0.219672
   0.118172 0.181272 0.136540 1.092860 0.097008
13 0.035215 0.003393 0.000000 0.000460 0.003327 0.002701 0.001387 0.010081
   0.001696 0.014926 0.001716 0.000855 1.008898
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.005035 1.002410 0.000000 0.001075 0.000900 0.001822 0.001452 0.002230
   0.013604 0.004038 0.001244 0.000897 0.121407 0.002048



 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001261 0.000018 0.000000 1.000012 0.000014 0.000020 0.000013 0.000042
   0.000013 0.000061 0.000014 0.000006 0.003566 0.000029
 5 0.011211 0.010447 0.000000 0.018554 1.003145 0.017298 0.014789 0.011868
   0.012947 0.014111 0.013365 0.004418 0.007645 0.050922
 6 0.152561 0.130213 0.000000 0.109547 0.054480 1.130648 0.207951 0.222750
   0.341730 0.244427 0.085994 0.041830 0.103958 0.131173
 7 0.118280 0.140103 0.000000 0.200381 0.099204 0.409259 1.453035 0.404357
   0.424332 0.445079 0.120310 0.141039 0.113515 0.239130
 8 0.081635 0.032487 0.000000 0.070888 0.013812 0.061120 0.051702 1.079557
   0.052154 0.061968 0.053134 0.035047 0.063173 0.118800
 9 0.050641 0.149753 0.000000 0.054735 0.036694 0.096585 0.083004 0.066037
   1.093912 0.164627 0.064731 0.058929 0.060313 0.087569
10 0.114359 0.114620 0.000000 0.177095 0.256498 0.198727 0.164672 0.127547
   0.137901 1.150783 0.155183 0.047206 0.149923 0.475775
11 0.174449 0.181459 0.000000 0.154689 0.057844 0.219966 0.182111 0.293536
   0.160840 0.259517 1.203371 0.048782 0.107868 0.387219
12 0.103501 0.111773 0.000000 0.130917 0.059664 0.210734 0.189761 0.292349
   0.197460 0.267683 0.218383 1.119914 0.143827 0.311842
13 0.037048 0.005102 0.000000 0.003494 0.003841 0.005530 0.003806 0.012022
   0.003814 0.017234 0.003901 0.001578 1.010148 0.008328
14 0.271260 0.252778 0.000000 0.448914 0.076097 0.418535 0.357829 0.287149
   0.313269 0.341411 0.323361 0.106891 0.184984 1.232094
```

MULT.OUT

The output from the MULT.FOR program contains information on direct, indirect, and induced income effects, including Type I and Type II multipliers.

INCOME MULTIPLIERS

INDUSTRY	DIRECT INCOME CHANGE	DIRECT AND INDIRECT INCOME CHANGE	INDIRECT INCOME CHANGE	TYPE I MULTIPLIER	DIRECT, INDIRECT AND INDUCED INCOME CHANGE	INDUCED INCOME CHANGE	INDIRECT & INDUCED INCOME CHANGE	TYPE II MULTIPLIER
HARD-ROCK MINING	0.15	0.22	0.07	1.47	0.27	0.05	0.12	1.81
PLACER MINING	0.13	0.21	0.08	1.60	0.25	0.05	0.12	1.97
FORESTRY	0.32	0.36	0.04	1.13	0.45	0.08	0.13	1.39
OIL AND GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANSPORTATION	0.23	0.34	0.11	1.46	0.42	0.08	0.19	1.80
CONSTRUCTION	0.16	0.29	0.13	1.81	0.36	0.07	0.20	2.23
UTILITIES	0.07	0.23	0.16	3.33	0.29	0.05	0.22	4.10
WHOLESALE TRADE	0.09	0.25	0.16	2.70	0.31	0.06	0.22	3.33
RETAIL TRADE	0.11	0.28	0.17	2.53	0.34	0.06	0.23	3.12
SERVICES	0.21	0.26	0.06	1.28	0.32	0.06	0.12	1.58
FINANCE, INSURANCE AND REAL ESTATE	0.05	0.09	0.04	1.90	0.11	0.02	0.06	2.34
MANUFACTURING	0.07	0.15	0.08	2.15	0.18	0.03	0.12	2.64

YRB

Program: IMPACN.FOR
Inputs: YRB.DAT
INV.OUT
Outputs: IMPACT.OUT
CHECK.DAT

IMPACN.FOR

This program allows the user to interactively modify one or more final demand values and have the new transactions table produced. Options open to the user and means of implementing them are fully documented and clearly shown during a terminal session in which IMPACN.FOR is run.

```
C
C     THIS PROGRAM ALLOWS THE USER TO INTERACTIVELY MODIFY THE VALUES
C     OF FINAL DEMANDS.  THE PROGRAM THEN CALCULATES THE NEW
C     TRANSACTIONS MATRIX ASSOCIATED WITH THESE FINAL DEMANDS.
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     A=DIRECT REQUIREMENTS MATRIX BY INDUSTRY AND INDUSTRY
C     AH=DIRECT REQUIREMENTS MATRIX WITH THE HOUSEHOLD ROW AND COLUMN
C        INCLUDED BY INDUSTRY AND INDUSTRY
C     FD=FINAL DEMAND MATRIX BY INDUSTRY AND FINAL DEMAND CATEGORY
C     FDVEC=TOTAL FINAL DEMAND BY INDUSTRY
C     HC=HOUSEHOLD COEFFICIENT COLUMN (PERSONAL EXPENDITURE) BY
C        INDUSTRY
C     HR=HOUSEHOLD COEFFICIENT ROW (WAGES, SALARIES AND SUPPLEMENTARY
C        LABOUR INCOME) BY INDUSTRY
C     IAHINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX INCLUDING THE HOUSEHOLD ROW AND COLUMN BY INDUSTRY
C        AND INDUSTRY
C     IAINV=INVERSE OF IDENTITY MATRIX MINUS DIRECT REQUIREMENTS
C        MATRIX BY INDUSTRY AND INDUSTRY
C     IO=ORIGINAL INPUT-OUTPUT MATRIX BY INDUSTRY OR FINAL PAYMENT
C        CATEGORY AND INDUSTRY OR FINAL DEMAND CATEGORY
C     M=IMPORTS BY INDUSTRY (WHICH PRODUCES THE IMPORT)
C     MFD=FINAL DEMAND AS IT IS MODIFIED BY THE USER BY INDUSTRY AND
C        FINAL DEMAND CATEGORY
C     NETO=NET OUTPUT ASSOCIATED WITH MODIFIED FINAL DEMAND BY
C        INDUSTRY
C     NEWGO=GROSS OUTPUT ASSOCIATED WITH MODIFIED FINAL DEMAND BY
C        INDUSTRY
C     NEWIO=INPUT-OUTPUT MATRIX ASSOCIATED WITH MODIFIED FINAL DEMAND
C        BY INDUSTRY OR FINAL PAYMENT CATEGORY AND IDUSTRY OR FINAL
C        DEMAND CATEGORY
C     NEWM=IMPORTS ASSOCIATED WITH MODIFIED FINAL DEMAND BY INDUSTRY
C        (WHICH PRODUCES THE IMPORT)
C     NEWTOT=TOTAL FINAL DEMAND ASSOCIATED WITH MODIFIED FINAL DEMAND
C         BY INDUSTRY OR FINAL PAYMENT CATEGORY AND FINAL DEMAND
C        CATEGORY
C     NRLY=RESIDUAL LABOUR INCOME ASSOCIATED WITH MODIFIED FINAL DEMAND
C        DEMAND BY INDUSTRY
C     RLY=RESIDUAL LABOUR INCOME BY INDUSTRY
C
C     INTEGER AND COUNTER VARIABLES
C
C     I=COUNTER VARIABLE
C     J=COUNTER VARIABLE
C     NFD=ALPHABETIC LETTER FOR FINAL DEMAND CATEGORY ASSOCIATED WITH
C        NUMERIC COUNTER BY FINAL DEMAND CATEGORY
C     NN=CODE FOR 'N' (OR NO) ANSWER
C     NOCHG=INDICATES CHANGES HAVE BEEN MADE TO FINAL DEMAND CATEGORY
C        IF NON-ZERO BY FINAL DEMAND CATEGORY
```

```
C     NY=CODE FOR 'Y' (OR YES) ANSWER
C     R1, R2, R3, R4 AND R5=USER RESPONSE TO QUESTIONS
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;
C        13=MANUFACTURING; 14=HOUSEHOLDS
C     FINAL DEMAND CATEGORIES:  15 (OR 1)=VALUE OF PHYSICAL CHANGE IN
C        INVENTORIES; 16 (OR 2)=EXPORTS; 17 (OR 3)=GOVERNMENT;
C        18 (OR 4)=GROSS FIXED CAPITAL FORMATION; 19 (OR 5)=CONSUMPTION
C     FINAL PAYMENT CATEGORIES:  15=INDIRECT TAXES LESS SUBSIDIES;
C        16=OTHER OPERATING SURPLUS; 17= DEPRECIATION; 18=NET INCOME
C        OF UNINCORPORATED BUSINESS; 19=LABOUR INCOME; 20=IMPORTS
C     OTHER COLUMN COUNTERS:  14=SUM OF COLUMNS 1 TO 13; 20=SUM OF
C        COLUMNS 15 TO 19; 21=SUM OF COLUMNS 14 AND 20
C     OTHER ROW COUNTERS:  14=SUM OF ROWS 1 TO 13; 21=SUM OF ROWS 15
C        TO 19; 22 =SUM OF ROWS 14 AND 21
C
      REAL*8 A(13,13)
      REAL*8 AH(14,14)
      REAL*8 FD(14,5)
      REAL*8 FDVEC(14)
      REAL*8 HC(14)
      REAL*8 HR(14)
      REAL*8 IAHINV(14,14)
      REAL*8 IAINV(13,13)
      REAL*8 IO(22,22)
      REAL*8 M(22)
      REAL*8 MFD(14,5)
      REAL*8 NETO(13)
      REAL*8 NEWGO(14)
      REAL*8 NEWIO(22,22)
      REAL*8 NEWM(13)
      REAL*8 NEWTOT(5)
      REAL*8 NRLY(13)
      REAL*8 RLY(13)
C
      INTEGER I, J, NFD(5), NN, NOCHG(5), NY
      INTEGER R1, R2, R3, R4, R5
C
      DATA A /169*0D0/
      DATA AH /196*0D0/
      DATA FD /70*0D0/
      DATA FDVEC /14*0D0/
      DATA HC /14*0D0/
      DATA HR /14*0D0/
      DATA IAHINV /196*0D0/
      DATA IAINV /169*0D0/
      DATA IO /484*0D0/
      DATA M /22*0D0/
      DATA MFD /70*0D0/
      DATA NETO /13*0D0/
      DATA NEWGO /14*0D0/
      DATA NEWIO /484*0D0/
      DATA NEWM /13*0D0/
      DATA NEWTOT /5*0D0/
      DATA NRLY /13*0D0/
      DATA RLY /13*0D0/
C
      DATA NN /'N'/
      DATA NOCHG /5*0D0/
      DATA NY /'Y'/
C
      OPEN(UNIT=5,DEVICE='TTY')
      OPEN(UNIT=6,DEVICE='TTY')
      OPEN(UNIT=8,DEVICE='DSK',FILE='YRB.DAT')

      OPEN(UNIT=9,DEVICE='DSK',FILE='INV.OUT')
      OPEN(UNIT=10,DEVICE='DSK',FILE='IMPACT.OUT')
      OPEN(UNIT=12,DEVICE='DSK',FILE='CHECK.DAT')
C
C     INPUT ROUTINE
C
      DO 1 I=1,13
1     READ(9,2)(A(I,J),J=1,13)
2     FORMAT(3X,8F9.6/3X,5F9.6)
      READ(9,3)(HR(I),I=1,14)
3     FORMAT(3X,8F9.6/3X,6F9.6)
      READ(9,3)(HC(I),I=1,14)
      DO 4 I=1,13
4     READ(9,2)(IAINV(I,J),J=1,13)
      DO 5 I=1,14
5     READ(9,3)(IAHINV(I,J),J=1,14)
      DO 6 I=1,22
6     READ(8,7)(IO(I,J),J=1,22)
7     FORMAT(3X,8F9.0/3X,8F9.0/3X,6F9.0)
      DO 8 I=1,14
8     READ(8,9)(FD(I,J),J=1,5)
9     FORMAT(3X,5F9.0)
      READ(8,7)(M(I),I=1,22)
10    FORMAT(3X,8F9.0/3X,5F9.0)
      READ(8,10)(RLY(I),I=1,13)
      DO 15 I=1,13
      DO 15 J=1,13
15    AH(I,J)=A(I,J)
      DO 16 I=1,13
16    AH(I,14)=HC(I)
      DO 17 J=1,14
17    AH(14,J)=HR(J)
      NFD(1)='A'
      NFD(2)='B'
      NFD(3)='C'
      NFD(4)='D'
      NFD(5)='E'
C
C     SELECTION OF OPTION
C
      WRITE(6,40)
40    FORMAT(' WELCOME TO THE INTERACTIVE FINAL DEMAND MODIFICATION')
      WRITE(6,41)
41    FORMAT(' ROUTINE OF THE IMPACT CALCULATION PROGRAM.')
49    FORMAT(' RESPONSE INVALID - PLEASE RE-TYPE')
```

```
C
C         FINAL DEMAND MODIFICATION.
C
      DO 140 I=1,13
      DO 140 J=1,5
140   MFD(I,J)=FD(I,J)
      WRITE(6,55)
55    FORMAT(' FINAL DEMAND CATEGORIES:')
      WRITE(6,56)
56    FORMAT('    A. VALUE OF THE PHYSICAL CHANGE IN INVENTORIES')
      WRITE(6,57)
57    FORMAT('    B. EXPORTS')
      WRITE(6,58)
58    FORMAT('    C. GOVERNMENT')
      WRITE(6,59)

59    FORMAT('    D. GROSS FIXED CAPITAL FORMATION')
      WRITE(6,60)
60    FORMAT('    E. CONSUMPTION')
      WRITE(6,61)
61    FORMAT(' INDUSTRY CATEGORIES:')
      WRITE(6,62)
62    FORMAT('    1. HARD-ROCK MINING')
      WRITE(6,63)
63    FORMAT('    2. PLACER MINING')
      WRITE(6,64)
64    FORMAT('    3. OIL AND GAS')
      WRITE(6,65)
65    FORMAT('    4. FORESTRY')
      WRITE(6,66)
66    FORMAT('    5. FISHING, HUNTING, TRAPPING AND SUBSISTENCE')
      WRITE(6,67)
67    FORMAT('    6. TRANSPORTATION')
      WRITE(6,68)
68    FORMAT('    7. CONSTRUCTION')
      WRITE(6,69)
69    FORMAT('    8. UTILITIES')
      WRITE(6,70)
70    FORMAT('    9. WHOLESALE TRADE')
      WRITE(6,71)
71    FORMAT('   10. RETAIL TRADE')
      WRITE(6,72)
72    FORMAT('   11. SERVICES')
      WRITE(6,73)
73    FORMAT('   12. FINANCE, INSURANCE, AND REAL ESTATE')
      WRITE(6,74)
74    FORMAT('   13. MANUFACTURING')
      WRITE(6,75)
75    FORMAT(' DO YOU WISH TO REVIEW THE DEFAULT FINAL DEMAND')
      WRITE(6,76)
76    FORMAT(' VALUES FOR EACH INDUSTRY? (TYPE Y OR N)')
79    READ(5,77)R2
77    FORMAT(A1)
      IF(R2.EQ.NY.OR.R2.EQ.NN)GO TO 78
      WRITE(6,49)
      GO TO 79
```

```
78    IF(R2.EQ.NN)GO TO 80
      CALL WRITFD(FD,R1)
80    WRITE(6,81)
81    FORMAT(' DO YOU WISH TO CHANGE ANY OF THE DEFAULT VALUES')
      WRITE(6,82)
82    FORMAT(' OF FINAL DEMAND? (TYPE Y OR N)')
85    READ(5,83)R3
83    FORMAT(A1)
      IF(R3.EQ.NY.OR.R3.EQ.NN)GO TO 84
      WRITE(6,49)
      GO TO 85
84    IF(R3.EQ.NN)GO TO 95
      WRITE(6,86)
86    FORMAT(' WHICH CATEGORY? (TYPE A, B, C, D, OR E)')
92    READ(5,87)R4
87    FORMAT(A1)
      DO 88 I=1,5
      IF(R4.EQ.NFD(I))GO TO 89
88    CONTINUE
      WRITE(6,49)
      GO TO 92
89    R4=I
      CALL READFD(MFD,R1,R4)
      NOCHG(R4)=1
      WRITE(6,91)
91    FORMAT(' DO YOU HAVE ANY OTHER CHANGES? (TYPE Y OR N)')
      GO TO 85
95    WRITE(6,150)
150   FORMAT(' DO YOU WISH TO SEE THE NEW FINAL DEMAND VALUES?')
      WRITE(6,151)
151   FORMAT(' (TYPE Y OR N)')
152   READ(5,153) R5
153   FORMAT(A1)
      IF (R5.EQ.NY.OR.R5.EQ.NN) GO TO 154
      WRITE(6,49)
      GO TO 152
154   IF (R5.EQ.NN) GO TO 155
      CALL WRITFD(MFD,R1)
155   WRITE(6,96)
96    FORMAT(' THE TRANSACTIONS TABLE CORRESPONDING TO THESE FINAL')
      WRITE(6,97)
97    FORMAT(' DEMAND VALUES WILL NOW BE CALCULATED AND PRINTED AT')
      WRITE(6,98)
98    FORMAT(' THE LINE PRINTER')
C
C     OPTION 1:  IMPACT CALCULATION
C
      DO 102 J=1,5
      DO 102 I=1,13
102   FDVEC(I)=FDVEC(I)+MFD(I,J)
      DO 103 I=1,13
      DO 103 J=1,13
103   NEWGO(I)=NEWGO(I)+IAINV(I,J)*FDVEC(J)
      DO 104 I=1,13
      DO 104 J=1,13
104   NEWIO(I,J)=A(I,J)*NEWGO(J)
```

```
      DO 105 I=1,13
      DO 105 J=1,13
105   NEWIO(14,J)=NEWIO(14,J)+NEWIO(I,J)
      DO 106 I=1,13
      DO 106 J=1,13
106   NEWIO(I,14)=NEWIO(I,14)+NEWIO(I,J)
      DO 107 J=1,13
107   NEWIO(14,14)=NEWIO(14,14)+NEWIO(14,J)
      DO 108 I=1,13
      DO 108 J=15,19
108   NEWIO(I,J)=MFD(I,J-14)
      DO 109 I=1,13
      DO 109 J=15,19
109   NEWIO(14,J)=NEWIO(14,J)+NEWIO(I,J)
      DO 110 I=1,13
      DO 110 J=15,19
110   NEWIO(I,21)=NEWIO(I,21)+NEWIO(I,J)
      DO 111 J=15,19
111   NEWIO(14,21)=NEWIO(14,21)+NEWIO(14,J)
      DO 112 I=1,14
112   NEWIO(I,22)=NEWIO(I,14)+NEWIO(I,21)
      DO 120 I=15,20
      DO 120 J=1,13
120   NEWIO(I,J)=(IO(I,J)/IO(22,J))*NEWGO(J)

      DO 121 I=15,20
      DO 121 J=1,13
121   NEWIO(I,14)=NEWIO(I,14)+NEWIO(I,J)
      DO 122 J=15,19
122   NEWTOT(J-14)=NEWIO(14,J)*(IO(22,J)/IO(14,J))
      DO 123 I=15,20
      DO 123 J=15,19
123   NEWIO(I,J)=(IO(I,J)/IO(22,J))*NEWTOT(J-14)
      DO 124 I=15,20
      DO 124 J=15,19
124   NEWIO(I,21)=NEWIO(I,21)+NEWIO(I,J)
      DO 125 I=15,20
125   NEWIO(I,22)=NEWIO(I,14)+NEWIO(I,21)
      DO 126 I=15,20
      DO 126 J=1,22
126   NEWIO(21,J)=NEWIO(21,J)+NEWIO(I,J)
      DO 127 J=1,22
127   NEWIO(22,J)=NEWIO(14,J)+NEWIO(21,J)
      DO 130 I=1,13
130   NEWM(I)=NEWGO(I)*(M(I)/IO(I,22))
      DO 131 I=1,13
131   NETO(I)=NEWGO(I)-NEWM(I)
      GO TO 300
C
C     DISK FILE OUTPUT ROUTINE
C
300   WRITE(10,420)(NEWGO(I),I=1,13)
420   FORMAT(' NO',8F9.0/3X,5F9.0)
      DO 421 I=1,13
421   WRITE(10,422) I,(NEWIO(I,J),J=15,19)
422   FORMAT(I3,5F9.0)
```

```
C
C     LINE PRINTER OUTPUT ROUTINE
C
      WRITE(12,301)
  301 FORMAT('1',55X,'NEW TRANSACTIONS TABLE')
      WRITE(12,302)
  302 FORMAT(' ',63X,'PAGE 1')
      WRITE(12,303)
  303 FORMAT('0',56X,'THOUSANDS OF DOLLARS')
      WRITE(12,304)
  304 FORMAT('0',85X,'FISHING, HUNTING,')
      WRITE(12,305)
  305 FORMAT(' ',33X,'HARD-ROCK',7X,'PLACER',33X,'TRAPPING AND',5X,
     1 'TRANS-')
      WRITE(12,306)
  306 FORMAT(' INDUSTRY',27X,'MINING',8X,'MINING',5X,'OIL AND GAS',5X,
     1 'FORESTRY',4X,'SUBSISTENCE',4X,'PORTATION',4X,'CONSTRUCTION')
      WRITE(12,307)(NEWIO(1,J),J=1,7)
  307 FORMAT('-',16HHARD-ROCK MINING,11X,7F14.0)
      WRITE(12,308)(NEWIO(2,J),J=1,7)
  308 FORMAT('-',13HPLACER MINING,14X,7F14.0)
      WRITE(12,309)(NEWIO(3,J),J=1,7)
  309 FORMAT('-',11HOIL AND GAS,16X,7F14.0)
      WRITE(12,310)(NEWIO(4,J),J=1,7)
  310 FORMAT('-',8HFORESTRY,19X,7F14.0)
      WRITE(12,311)
  311 FORMAT('OFISHING, HUNTING, TRAPPING')
      WRITE(12,312)(NEWIO(5,J),J=1,7)
  312 FORMAT(' ',15HAND SUBSISTENCE,12X,7F14.0)

      WRITE(12,313)(NEWIO(6,J),J=1,7)
  313 FORMAT('-',14HTRANSPORTATION,13X,7F14.0)
      WRITE(12,314)(NEWIO(7,J),J=1,7)
  314 FORMAT('-',12HCONSTRUCTION,15X,7F14.0)
      WRITE(12,315)(NEWIO(8,J),J=1,7)
  315 FORMAT('-',9HUTILITIES,18X,7F14.0)
      WRITE(12,316)(NEWIO(9,J),J=1,7)
  316 FORMAT('-',15HWHOLESALE TRADE,12X,7F14.0)
      WRITE(12,317)(NEWIO(10,J),J=1,7)
  317 FORMAT('-',12HRETAIL TRADE,15X,7F14.0)
      WRITE(12,318)(NEWIO(11,J),J=1,7)
  318 FORMAT('-',8HSERVICES,19X,7F14.0)
      WRITE(12,319)
  319 FORMAT('OFINANCE, INSURANCE')
      WRITE(12,320)(NEWIO(12,J),J=1,7)
  320 FORMAT(' ',15HAND REAL ESTATE,12X,7F14.0)
      WRITE(12,321)(NEWIO(13,J),J=1,7)
  321 FORMAT('-',13HMANUFACTURING,14X,7F14.0)
      WRITE(12,324)(NEWIO(14,J),J=1,7)
  324 FORMAT('-',16HTOTAL PROCESSING,11X,7F14.0)
      WRITE(12,322)
  322 FORMAT('OINDIRECT TAXES')
      WRITE(12,323)(NEWIO(15,J),J=1,7)
  323 FORMAT(' ',14HLESS SUBSIDIES,13X,7F14.0)
      WRITE(12,325)
  325 FORMAT('OOTHER OPERATING')
      WRITE(12,326)(NEWIO(16,J),J=1,7)
  326 FORMAT(' ',7HSURPLUS,20X,7F14.0)
```

```
      WRITE(12,327)(NEWIO(17,J),J=1,7)
327   FORMAT('-',12HDEPRECIATION,15X,7F14.0)
      WRITE(12,328)
328   FORMAT('0NET INCOME OF UNINCOR-')
      WRITE(12,329)(NEWIO(18,J),J=1,7)
329   FORMAT(' ',16HPORATED BUSINESS,11X,7F14.0)
      WRITE(12,330)(NEWIO(19,J),J=1,7)
330   FORMAT('-',13HLABOUR INCOME,14X,7F14.0)
      WRITE(12,331)(NEWIO(20,J),J=1,7)
331   FORMAT('-',7HIMPORTS,20X,7F14.0)
      WRITE(12,332)
332   FORMAT('0TOTAL FINAL')
      WRITE(12,333)(NEWIO(21,J),J=1,7)
333   FORMAT(' ',8HPAYMENTS,19X,7F14.0)
      WRITE(12,334)(NEWIO(22,J),J=1,7)
334   FORMAT('-',13HTOTAL OUTLAYS,14X,7F14.0)
      WRITE(12,400)
400   FORMAT('1',55X,'NEW TRANSACTIONS TABLE')
      WRITE(12,401)
401   FORMAT(' ',63X,'PAGE 2')
      WRITE(12,402)
402   FORMAT('0',56X,'THOUSANDS OF DOLLARS')
      WRITE(12,403)
403   FORMAT('0',90X,'FINANCE,',21X,'TOTAL')
      WRITE(12,404)
404   FORMAT(' ',47X,'WHOLESALE',7X,'RETAIL',18X,'INSURANCE AND',4X,
     1 'MANUFAC-',4X,'INTERMEDIATE')
      WRITE(12,405)
405   FORMAT(' INDUSTRY',25X,'UTILITIES',7X,'TRADE',9X,'TRADE',8X,
     1 'SERVICES',4X,'REAL ESTATE',6X,'TURING',6X,'PRODUCTION')
      WRITE(12,307)(NEWIO(1,J),J=8,14)
      WRITE(12,308)(NEWIO(2,J),J=8,14)

      WRITE(12,309)(NEWIO(3,J),J=8,14)
      WRITE(12,310)(NEWIO(4,J),J=8,14)
      WRITE(12,311)
      WRITE(12,312)(NEWIO(5,J),J=8,14)
      WRITE(12,313)(NEWIO(6,J),J=8,14)
      WRITE(12,314)(NEWIO(7,J),J=8,14)
      WRITE(12,315)(NEWIO(8,J),J=8,14)
      WRITE(12,316)(NEWIO(9,J),J=8,14)
      WRITE(12,317)(NEWIO(10,J),J=8,14)
      WRITE(12,318)(NEWIO(11,J),J=8,14)
      WRITE(12,319)
      WRITE(12,320)(NEWIO(12,J),J=8,14)
      WRITE(12,321)(NEWIO(13,J),J=8,14)
      WRITE(12,324)(NEWIO(14,J),J=8,14)
      WRITE(12,322)
      WRITE(12,323)(NEWIO(15,J),J=8,14)
      WRITE(12,325)
      WRITE(12,326)(NEWIO(16,J),J=8,14)
      WRITE(12,327)(NEWIO(17,J),J=8,14)
      WRITE(12,328)
      WRITE(12,329)(NEWIO(18,J),J=8,14)
      WRITE(12,330)(NEWIO(19,J),J=8,14)
      WRITE(12,331)(NEWIO(20,J),J=8,14)
      WRITE(12,332)
      WRITE(12,333)(NEWIO(21,J),J=8,14)
      WRITE(12,334)(NEWIO(22,J),J=8,14)
      WRITE(12,450)
450   FORMAT('1',55X,'NEW TRANSACTIONS TABLE')
      WRITE(12,451)
451   FORMAT(' ',63X,'PAGE 3')
      WRITE(12,452)
452   FORMAT('0',56X,'THOUSANDS OF DOLLARS')
      WRITE(12,453)
453   FORMAT('0',34X,'VALUE OF')
      WRITE(12,454)
454   FORMAT(' ',34X,'PHYSICAL',32X,'GROSS FIXED',34X,'TOTAL')
      WRITE(12,455)
455   FORMAT(' ',33X,'CHANGE IN',34X,'CAPITAL',36X,'GROSS')
      WRITE(12,456)
456   FORMAT(' INDUSTRY',24X,'INVENTORIES',5X,'EXPORTS',6X,'GOVERNMENT'
     1 ,4X,'FORMATION',4X,'CONSUMPTION',7X,'GDP',10X,'OUTPUT')
      WRITE(12,307)(NEWIO(1,J),J=15,19),NEWIO(1,21),NEWIO(1,22)
      WRITE(12,308)(NEWIO(2,J),J=15,19),NEWIO(2,21),NEWIO(2,22)
      WRITE(12,309)(NEWIO(3,J),J=15,19),NEWIO(3,21),NEWIO(3,22)
      WRITE(12,310)(NEWIO(4,J),J=15,19),NEWIO(4,21),NEWIO(4,22)
      WRITE(12,311)
      WRITE(12,312)(NEWIO(5,J),J=15,19),NEWIO(5,21),NEWIO(5,22)
      WRITE(12,313)(NEWIO(6,J),J=15,19),NEWIO(6,21),NEWIO(6,22)
      WRITE(12,314)(NEWIO(7,J),J=15,19),NEWIO(7,21),NEWIO(7,22)
      WRITE(12,315)(NEWIO(8,J),J=15,19),NEWIO(8,21),NEWIO(8,22)
      WRITE(12,316)(NEWIO(9,J),J=15,19),NEWIO(9,21),NEWIO(9,22)
      WRITE(12,317)(NEWIO(10,J),J=15,19),NEWIO(10,21),NEWIO(10,22)
      WRITE(12,318)(NEWIO(11,J),J=15,19),NEWIO(11,21),NEWIO(11,22)
      WRITE(12,319)
      WRITE(12,320)(NEWIO(12,J),J=15,19),NEWIO(12,21),NEWIO(12,22)
      WRITE(12,321)(NEWIO(13,J),J=15,19),NEWIO(13,21),NEWIO(13,22)
      WRITE(12,324)(NEWIO(14,J),J=15,19),NEWIO(14,21),NEWIO(14,22)
      WRITE(12,322)
      WRITE(12,323)(NEWIO(15,J),J=15,19),NEWIO(15,21),NEWIO(15,22)
      WRITE(12,325)

      WRITE(12,326)(NEWIO(16,J),J=15,19),NEWIO(16,21),NEWIO(16,22)
      WRITE(12,327)(NEWIO(17,J),J=15,19),NEWIO(17,21),NEWIO(17,22)
      WRITE(12,328)
      WRITE(12,329)(NEWIO(18,J),J=15,19),NEWIO(18,21),NEWIO(18,22)
      WRITE(12,330)(NEWIO(19,J),J=15,19),NEWIO(19,21),NEWIO(19,22)
      WRITE(12,331)(NEWIO(20,J),J=15,19),NEWIO(20,21),NEWIO(20,22)
      WRITE(12,332)
      WRITE(12,333)(NEWIO(21,J),J=15,19),NEWIO(21,21),NEWIO(21,22)
      WRITE(12,334)(NEWIO(22,J),J=15,19),NEWIO(22,21),NEWIO(22,22)
      STOP
      END
      SUBROUTINE READFD(MFD,R1,R4)
C
C     THIS SUBROUTINE READS THE NEW FINAL DEMAND VALUES WHICH THE USER
C     INPUTS AT THE TERMINAL
C
C     VARIABLE GLOSSARY AND DECLARATION
C
C     REAL VARIABLES
C
```

```
C     MFD=NEW VALUES OF FINAL DEMAND BY INDUSTRY AND FINAL DEMAND
C        CATEGORY
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER VARIABLE FOR INDUSTRY; I=1,2,....,13
C     R1=INDICATES OPTION 1 (HOUSEHOLDS EXOGENOUS) AND 2 (HOUSEHOLDS
C        ENDOGENOUS)
C     R4=FINAL DEMAND CATEGORY TO BE MODIFIED
C
      REAL*8 MFD(14,5)
C
      INTEGER I, R1, R4
C
      IF (R1.EQ.'2') GO TO 3
      WRITE(6,1)
1     FORMAT(' TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 13,')
      WRITE (6,2)
2     FORMAT(' SEPARATED BY COMMAS')
      READ(6,*)(MFD(I,R4),I=1,13)
      RETURN
3     WRITE(6,4)
4     FORMAT(' TYPE FINAL DEMAND VALUES FOR INDUSTRIES 1 TO 14,')
      WRITE (6,5)
5     FORMAT(' SEPARATED BY COMMAS')
      READ(6,*)(MFD(I,R4),I=1,14)
      RETURN
      END
      SUBROUTINE WRITFD(FD,R1)
C
C     THIS SUBROUTINE WRITES ALL THE VALUES OF FINAL DEMAND AT THE
C     TERMINAL
C
C     VARIABLE GLOSSARY AND DECLARATION
C
C     REAL VARIABLES
C
C     FD=VALUES OF FINAL DEMAND BY INDUSTRY AND FINAL DEMAND CATEGORY
C
C     INTEGER VARIABLES AND COUNTERS

C
C     I=COUNTER VARIABLE FOR INDUSTRY; I=1,2,....,13
C     NI=NUMBER OF INDUSTRIES
C     R1=INDICATES OPTION 1 (HOUSEHOLDS EXOGENOUS) AND 2 (HOUSEHOLDS
C        ENDOGENOUS)
C
      REAL*8 FD(14,5)
C
      INTEGER I, NI, R1
C
      IF (R1.EQ.'1') NI=13
      IF (R1.EQ.'2') NI=14
       NI=13
      WRITE(6,1)
1     FORMAT(' A. VALUE OF PHYSICAL CHANGE IN INVENTORIES')
      WRITE(6,2)(I,FD(I,1),I=1,NI)
```

```
2       FORMAT(I3,F10.1)
        WRITE(6,3)
3       FORMAT(' B. EXPORTS')
        WRITE(6,2)(I,FD(I,2),I=1,NI)
        WRITE(6,4)
4       FORMAT(' C. GOVERNMENT')
        WRITE(6,2)(I,FD(I,3),I=1,NI)
        WRITE(6,5)
5       FORMAT(' D. GROSS FIXED CAPITAL FORMATION')
        WRITE(6,2)(I,FD(I,4),I=1,NI)
        IF (R1.EQ.'2') RETURN
        WRITE(6,6)
6       FORMAT(' E. CONSUMPTION')
        WRITE(6,2)(I,FD(I,5),I=1,NI)
        RETURN
        END
```

YRB.DAT

This data set contains the initial 1978 Yukon River Basin transactions table.

```
   1          0          0          0          0          0          0          0          0
              0          0          0          0          0          0      17378     133213
              0          0          0          0     150591     150591
   2          0          0          0          0          0          0          0          0
            801          0          0          0        845       1645          0       1321
              0          0          0          0       1321       2966
   3          0          0          0          0          0          0          0          0
              0          0          0          0          0          0          0          0
              0          0          0          0          0          0
   4        170          0          0          0          0          0          0          0
              0          0          0          0         25        195          0          0
             12          0          0          0         12        207
   5          0          0          0          0          0          0          0          0
              0          0          0          0          0          0          0        934
              0          0       3696          0       4630       4630
   6      14193        160          0          8          0       1315       7800       2568
          15892       7959       1657         24        279      51855          0          0
           2392          0          0          0       2392      54247
   7        584         46          0         13          0      11001      17402       3897
          12454      13340        405       2813          4      61960          0          0
           2116      10475          0          0      12591      74551
   8       7177          5          0          5          0        638        567        746
            693        967        982        866        263      12908          0        665
            219          0       6605          0       7489      20397
   9       2584        337          0          3          0       2219       2148        198
           2415       6808       1648       1735         87      20183          0          0
          22992      23438          0          0      46430      66613
  10         56         29          0          0       1032       1479       1058          0
             75        155       1640        115        506       6145          0      22091
           6177          0      32311          0      60579      66724
  11       9304        234          0          0          0       3059       2564       3114
           1304       7011       5315        105         87      32097          0      12074
           1993          0      19555          0      33622     657719
  12         36         38          0          0          0       3074       3595       2924
           3935       7181       6699       3056        402      30939          0       1268
              0          0      11444          0      12712      43651
  13       5124          8          0          0          0         87         25        176
             32        906         55         17         48       6478          0          0
            594          0          0          0        594       7072
  14      39228        857          0         29       1032      22872      35159      13623
          37601      44327      18401       8730       2547     224406      17378     171566
          36495      33913      73611          0     332963     557369
  15        840          0          0          8          4       1636       2751         -2
              1        183       2176       3612         26      11235          0          0
              0          0          0          0          0      11235
  16      35234          0          0       -919          0     -21791       6900          0
           1848       2017      12211      26987       1308      63795          0          0
              0          0          0          0          0      63795
  17      13096          0          0        977          0      33102       4162          0
            113        122       4326        168        120      56186          0          0
           9068          0       2934          0      12002      68188
```

```
18           0       623         0         1      3594         0       602       199
            91       793      2849       518        29      9298         0         0
             0         0      6381         0      6381     15679
19       37053       624         0       110         0     12580     19705      2348
         10310     12021     22159      3275       814    120999         0         0
         46188         0         0         0     46188    167187
20       25142       862         0         1         0      5847      5273      4228
         16649      7260      3596       361      2231     71450       225         0


          6409     72980      6503         0     86116    157566
21      111365      2109         0       178      3598     31374     39393      6773
         29011     22396     47318     34921      4527    332963       225         0
         61664     72980     15818         0    150687    483650
22      150593      2966         0       207      4630     54246     74551     20397
         66613     66724     65719     43651      7072    557369     17603    171566
         98159    106893     89429         0    483650   1041019
 1       17378    133213         0         0         0
 2           0      1321         0         0         0
 3           0         0         0         0         0
 4           0         0        12         0         0
 5           0       934         0         0      3696
 6           0         0      2392         0         0
 7           0         0      2116     10475         0
 8           0       665       219         0      6605
 9           0         0     22992     23438         0
10           0     22091      6177         0     32311
11           0     12074      1993         0     19555
12           0      1268         0         0     11444
13           0         0       594         0         0
14           0         0     46188         0         0
 M       25142       862         0         1         0      5847      5273      4228
         16649      7260      3596       361      2231     71450       225         0
          6409     72980      6503     86116    157566
PY       14511       244         0        43         0      4926      7717       920
          4038      4708      8678      1283       319
```

INV.OUT

The direct plus indirect requirements matrices appear on the following pages for both the closed economy and open economy. The closed system is distinguished from the open system in that the household sector (Consumption column and Labour Income row) becomes part of the inter-industry matrix.

```
 1 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.012070 0.000000 0.000000 0.000000 0.119470
 3 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001130 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.003530
 5 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.094250 0.053940 0.000000 0.038650 0.000000 0.024240 0.104630 0.125900
   0.238580 0.119280 0.025210 0.000550 0.039450
 7 0.003880 0.015510 0.000000 0.062800 0.000000 0.202800 0.233420 0.191060
   0.186960 0.199930 0.006160 0.064440 0.000570
 8 0.047660 0.001690 0.000000 0.024150 0.000000 0.011760 0.007610 0.036570
   0.010400 0.014490 0.014940 0.019840 0.037180
 9 0.017160 0.113620 0.000000 0.014490 0.000000 0.040910 0.028810 0.009710
   0.036250 0.102030 0.025080 0.039750 0.012300
10 0.000370 0.009780 0.000000 0.000000 0.222890 0.027260 0.014190 0.000000
   0.001130 0.002320 0.024950 0.002630 0.071540
11 0.061780 0.078890 0.000000 0.000000 0.000000 0.056390 0.034390 0.152670
   0.019580 0.105080 0.080870 0.002410 0.012300
12 0.000240 0.012810 0.000000 0.000000 0.000000 0.056670 0.048220 0.143350
   0.059070 0.107620 0.101930 0.070010 0.056840
13 0.034030 0.002700 0.000000 0.000000 0.000000 0.001600 0.000340 0.008630
   0.000480 0.013580 0.000840 0.000390 0.006790
HR 0.149690 0.128120 0.000000 0.323670 0.000000 0.231910 0.160800 0.070010
   0.094160 0.109600 0.205130 0.045630 0.069980 0.000000
HC 0.000000 0.000000 0.000000 0.000000 0.041330 0.000000 0.000000 0.073860
   0.000000 0.361300 0.218670 0.127970 0.000000 0.000000
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.004584 1.001989 0.000000 0.000329 0.000774 0.001126 0.000858 0.001753
   0.013084 0.003470 0.000707 0.000719 0.121100
 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001254 0.000012 0.000000 1.000002 0.000012 0.000010 0.000005 0.000036
   0.000006 0.000053 0.000006 0.000003 0.003561
 5 0.000000 0.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000
 6 0.123681 0.103302 0.000000 0.061754 0.046379 1.086090 0.169855 0.192179
   0.308378 0.208079 0.051568 0.030450 0.084264
 7 0.065632 0.091042 0.000000 0.113254 0.084434 0.328028 1.383586 0.348626
   0.363532 0.378816 0.057551 0.120293 0.077612
 8 0.055480 0.008114 0.000000 0.027603 0.006475 0.020764 0.017200 1.051870
   0.021948 0.029049 0.021955 0.024740 0.045337
 9 0.031361 0.131787 0.000000 0.022829 0.031285 0.066838 0.057572 0.045628
   1.071647 0.140361 0.041748 0.051332 0.047165
10 0.009612 0.017010 0.000000 0.003746 0.227113 0.037109 0.026496 0.016664
   0.016932 1.018947 0.030317 0.005930 0.078491
11 0.069198 0.102017 0.000000 0.013606 0.033928 0.088430 0.069654 0.203292
   0.062387 0.152219 1.101746 0.015189 0.049732
12 0.034846 0.047796 0.000000 0.017297 0.040404 0.104803 0.099194 0.219672
   0.118172 0.181272 0.136540 1.092860 0.097008
13 0.035215 0.003393 0.000000 0.000460 0.003327 0.002701 0.001387 0.010081
   0.001696 0.014926 0.001716 0.000855 1.008898
 1 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 2 0.005035 1.002410 0.000000 0.001075 0.000900 0.001822 0.001452 0.002230
   0.013604 0.004038 0.001244 0.000897 0.121407 0.002048



 3 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000
   0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
 4 0.001261 0.000018 0.000000 1.000012 0.000014 0.000020 0.000013 0.000042
   0.000013 0.000061 0.000014 0.000006 0.003566 0.000029
 5 0.011211 0.010447 0.000000 0.018554 1.003145 0.017298 0.014789 0.011868
   0.012947 0.014111 0.013365 0.004418 0.007645 0.050922
 6 0.152561 0.130213 0.000000 0.109547 0.054480 1.130648 0.207951 0.222750
   0.341730 0.244427 0.085994 0.041830 0.103958 0.131173
 7 0.118280 0.140103 0.000000 0.200381 0.099204 0.409259 1.453035 0.404357
   0.424332 0.445079 0.120310 0.141039 0.113515 0.239130
 8 0.081635 0.032487 0.000000 0.070888 0.013812 0.061120 0.051702 1.079557
   0.052154 0.061968 0.053134 0.035047 0.063173 0.118800
 9 0.050641 0.149753 0.000000 0.054735 0.036694 0.096585 0.083004 0.066037
   1.093912 0.164627 0.064731 0.058929 0.060313 0.087569
10 0.114359 0.114620 0.000000 0.177095 0.256498 0.198727 0.164672 0.127547
   0.137901 1.150783 0.155183 0.047206 0.149923 0.475775
11 0.174449 0.181459 0.000000 0.154689 0.057844 0.219966 0.182111 0.293536
   0.160840 0.259517 1.203371 0.048782 0.107868 0.387219
12 0.103501 0.111773 0.000000 0.130917 0.059664 0.210734 0.189761 0.292349
   0.197460 0.267683 0.218383 1.119914 0.143827 0.311842
13 0.037048 0.005102 0.000000 0.003494 0.003841 0.005530 0.003806 0.012022
   0.003814 0.017234 0.003901 0.001578 1.010148 0.008328
14 0.271260 0.252778 0.000000 0.448914 0.076097 0.418535 0.357829 0.287149
   0.313269 0.341411 0.323361 0.106891 0.184984 1.232094
```

IMPACT.OUT

This output of IMPACN.FOR contains total outlays of industries 1 to 13 and final demand values of 5 sectors for the output of industries 1 to 13.

```
NO  150591.     2967.        0.      207.      4630.    54247.    74550.    20398.
     60612.    66723.    65719.    43651.      7073.
 1   17378.   133213.        0.        0.         0.
 2       0.     1321.        0.        0.         0.
 3       0.        0.        0.        0.         0.
 4       0.        0.       12.        0.         0.
 5       0.      934.        0.        0.      3696.
 6       0.        0.     2392.        0.         0.
 7       0.        0.     2116.    10475.         0.
 8       0.      665.      219.        0.      6605.
 9       0.        0.    22992.    23438.         0.
10       0.    22091.     6177.        0.     32311.
11       0.    12074.     1993.        0.     19555.
12       0.     1268.        0.        0.     11444.
13       0.        0.      594.        0.         0.
```

CHECK.DAT

This output of IMPACN.FOR contains the transactions table corresponding to changes made by the user during the operation of IMPACN.FOR.

NEW TRANSACTIONS TABLE
PAGE 1

THOUSANDS OF DOLLARS

INDUSTRY	HARD-ROCK MINING	PLACER MINING	OIL AND GAS	FORESTRY	FISHING, HUNTING, TRAPPING AND SUBSISTENCE	TRANS-PORTATION	CONSTRUCTION
HARD-ROCK MINING	0.	0.	0.	0.	0.	0.	0.
PLACER MINING	0.	0.	0.	0.	0.	0.	0.
OIL AND GAS	0.	0.	0.	0.	0.	0.	0.
FORESTRY	170.	0.	0.	0.	0.	0.	0.
FISHING, HUNTING, TRAPPING AND SUBSISTENCE	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION	14193.	160.	0.	8.	0.	1315.	2800.
CONSTRUCTION	584.	46.	0.	13.	0.	11001.	2401.
UTILITIES	7177.	5.	0.	5.	0.	638.	567.
WHOLESALE TRADE	2584.	337.	0.	3.	0.	2219.	2148.
RETAIL TRADE	56.	29.	0.	0.	1032.	1479.	1058.
SERVICES	9304.	234.	0.	0.	0.	3059.	2564.
FINANCE, INSURANCE AND REAL ESTATE	36.	38.	0.	0.	0.	3074.	3595.
MANUFACTURING	5125.	8.	0.	0.	0.	87.	25.
TOTAL PROCESSING	39229.	857.	0.	29.	1032.	22872.	15158.

	HARD-ROCK MINING	PLACER MINING	OIL AND GAS	FORESTRY	FISHING, HUNTING, TRAPPING AND SUBSISTENCE	TRANS-PORTATION	CONSTRUCTION
INDIRECT TAXES LESS SUBSIDIES	840.	0.	0.	8.	4.	1636.	2751.
OTHER OPERATING SURPLUS	35234.	0.	0.	-920.	0.	-21791.	6900.
DEPRECIATION	13096.	0.	0.	978.	0.	33103.	4162.
NET INCOME OF UNINCORPORATED BUSINESS	0.	623.	0.	1.	3594.	0.	602.
LABOUR INCOME	37053.	624.	0.	110.	0.	12580.	19705.
IMPORTS	25142.	862.	0.	1.	0.	5847.	5273.
TOTAL FINAL PAYMENTS	111364.	2109.	0.	178.	3598.	31375.	39392.
TOTAL OUTLAYS	150592.	2967.	0.	207.	4630.	54247.	74551.

NEW TRANSACTIONS TABLE
PAGE 2

THOUSANDS OF DOLLARS

INDUSTRY	UTILITIES	WHOLESALE TRADE	RETAIL TRADE	SERVICES	FINANCE, INSURANCE AND REAL ESTATE	MANUFAC-TURING	TOTAL INTERMEDIATE PRODUCTION
HARD-ROCK MINING	0.	0.	0.	0.	0.	0.	0.
PLACER MINING	0.	801.	0.	0.	0.	845.	1646.
OIL AND GAS	0.	0.	0.	0.	0.	0.	0.
FORESTRY	0.	0.	0.	0.	0.	25.	195.
FISHING, HUNTING, TRAPPING AND SUBSISTENCE	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION	2568.	15892.	7959.	1657.	24.	279.	51855.
CONSTRUCTION	3897.	12454.	13340.	405.	2813.	4.	61959.
UTILITIES	746.	693.	967.	982.	866.	263.	12909.
WHOLESALE TRADE	198.	2415.	6808.	1648.	1735.	87.	20182.
RETAIL TRADE	0.	75.	155.	1640.	115.	506.	6144.
SERVICES	3114.	1304.	7011.	5315.	105.	87.	32097.
FINANCE, INSURANCE AND REAL ESTATE	2924.	3935.	7181.	6699.	3056.	402.	30939.
MANUFACTURING	176.	32.	906.	55.	17.	48.	6479.
TOTAL PROCESSING	13624.	37601.	44326.	18400.	8731.	2546.	224405.

	UTILITIES	WHOLESALE TRADE	RETAIL TRADE	SERVICES	FINANCE, INSURANCE AND REAL ESTATE	MANUFACTURING	TOTAL INTERMEDIATE PRODUCTION
INDIRECT TAXES LESS SUBSIDIES	-2.	1.	183.	2176.	3612.	26.	11235.
OTHER OPERATING SURPLUS	0.	1848.	2017.	12211.	26987.	1308.	63794.
DEPRECIATION	0.	113.	122.	4326.	168.	120.	56187.
NET INCOME OF UNINCORPORATED BUSINESS	199.	91.	793.	2849.	518.	28.	9298.
LABOUR INCOME	2348.	10310.	12021.	22159.	3275.	814.	120999.
IMPORTS	4228.	16649.	7260.	3596.	361.	2231.	71450.
TOTAL FINAL PAYMENTS	6773.	29012.	22396.	47317.	34921.	4528.	332963.
TOTAL OUTLAYS	20397.	66612.	66722.	65717.	43653.	7074.	557368.

NEW TRANSACTIONS TABLE
PAGE 3

THOUSANDS OF DOLLARS

INDUSTRY	VALUE OF PHYSICAL CHANGE IN INVENTORIES	EXPORTS	GOVERNMENT	GROSS FIXED CAPITAL FORMATION	CONSUMPTION	GDP	TOTAL GROSS OUTPUT
HARD-ROCK MINING	17378.	133213.	0.	0.	0.	150591.	150591.
PLACER MINING	0.	1321.	0.	0.	0.	1321.	2967.
OIL AND GAS	0.	0.	0.	0.	0.	0.	0.
FORESTRY	0.	0.	12.	0.	0.	12.	207.
FISHING, HUNTING, TRAPPING AND SUBSISTENCE	0.	934.	0.	0.	3696.	4630.	4630.
TRANSPORTATION	0.	0.	2392.	0.	0.	2392.	54247.
CONSTRUCTION	0.	0.	2116.	10475.	0.	12591.	74550.
UTILITIES	0.	665.	219.	0.	6605.	7489.	20398.
WHOLESALE TRADE	0.	0.	22992.	23438.	0.	46430.	66612.
RETAIL TRADE	0.	22091.	6177.	0.	32311.	60579.	66723.
SERVICES	0.	12074.	1993.	0.	19555.	33622.	65719.
FINANCE, INSURANCE AND REAL ESTATE	0.	1268.	0.	0.	11444.	12712.	43651.
MANUFACTURING	0.	0.	594.	0.	0.	594.	7073.
TOTAL PROCESSING	17378.	171566.	36495.	33913.	73611.	332963.	557368.

	VALUE OF PHYSICAL CHANGE IN INVENTORIES	EXPORTS	GOVERNMENT	GROSS FIXED CAPITAL FORMATION	CONSUMPTION	GDP	TOTAL GROSS OUTPUT
INDIRECT TAXES LESS SUBSIDIES	0.	0.	0.	0.	0.	0.	1[illegible]235.
OTHER OPERATING SURPLUS	0.	0.	0.	0.	0.	0.	6[illegible]794.
DEPRECIATION	0.	0.	9068.	0.	2934.	12002.	6[illegible]189.
NET INCOME OF UNINCORPORATED BUSINESS	0.	0.	0.	0.	6381.	6381.	1[illegible]679.
LABOUR INCOME	0.	0.	46180.	0.	0.	46180.	16[illegible]187.
INPUTS	225.	0.	6409.	72980.	6503.	86117.	157567.
TOTAL FINAL PAYMENTS	225.	0.	61665.	72980.	15818.	150688.	483651.
TOTAL OUTLAYS	17603.	171566.	98160.	106893.	89429.	483651.	1041019.

YRB

Program:	PHYSIN.FOR
Inputs:	PHYSIN.IN1
	PHYSIN.IN2
	IMPACT.OUT
Output:	PHYSIN.OUT

PHYSIN.FOR

This program calculates physical input requirements necessary to support levels of final demand that are read in as inputs.

```
C
C     GIVEN A SET OF GROSS OUTPUTS, THIS PROGRAM CALCULATES THE
C     PHYSICAL INPUT REQUIREMENTS NECESSARY TO SUPPORT THE ASSOCIATED
C     LEVELS OF FINAL DEMAND.
C
C     VARIABLE GLOSSARY, DECLARATION AND INITIALIZATION
C
C     REAL VARIABLES
C
C     FINAL=FINAL DEMAND BY INDUSTRY AND FINAL DEMAND CATEGORY
C     NEWOUT=NEW GROSS OUTPUTS BY INDUSTRY
C     NEWPI=NEW PHYSICAL INPUT REQUIREMENTS IMPLIED BY THE NEW GROSS
C        OUTPUTS BY INDUSTRY
C     OUTPUT=1978 GROSS OUTPUT BY INDUSTRY
C     PI=1978 PHYSICAL INPUT REQUIREMENTS BY INDUSTRY
C     PIPDGO=1978 PHYSICAL INPUT REQUIREMENTS PER DOLLAR 1978 GROSS
C        OUTPUT BY INDUSTRY
C     TITLE=TITLE OF PHYSICAL INPUT REQUIREMENT
C     UNIT=UNITS OF MEASUREMENT OF PHYSICAL INPUT REQUIREMENT
C
C     INTEGER VARIABLES AND COUNTERS
C
C     I=COUNTER FOR INDUSTRY; I=1,2,...,NI
C     INDUSTRY CATEGORIES:  1=HARD-ROCK MINING; 2=PLACER MINING;
C        3=OIL AND GAS; 4=FORESTRY; 5=HUNTING, FISHING, TRAPPING
C        AND SUBSISTENCE; 6=TRANSPORTATION; 7=CONSTRUCTION;
C        8=UTILITIES; 9=WHOLESALE TRADE; 10=RETAIL TRADE;
C        11=SERVICES; 12=FINANCE, INSURANCE AND REAL ESTATE;
C        13=MANUFACTURING; 14=HOUSEHOLDS
C     J=COUNTER FOR FINAL DEMAND CATEGORY; J=1,2,...,5
C     FINAL DEMAND CATEGORIES:  1=INVENTORIES; 2=EXPORTS; 3=GOVERNMENT;
C        4=GROSS FIXED CAPITAL FORMATION; 5= CONSUMPTION
C     NI=NUMBER OF INDUSTRIES
C
      REAL*8 FINAL(13,5)
      REAL*8 NEWOUT(13)
      REAL*8 NEWPI(13)
      REAL*8 OUTPUT(13)
      REAL*8 PI(13)
      REAL*8 PIPDGO(13)
      REAL*8 TITLE
      REAL*8 UNIT
C
      INTEGER I, J, NI
C
      DATA FINAL /65*0D0/
      DATA NEWOUT /13*0D0/
      DATA NEWPI /13*0D0/
      DATA OUTPUT /13*0D0/
      DATA PI /13*0D0/
      DATA PIPDGO /13*0D0/
```

```
C
      OPEN(UNIT=8,DEVICE='DSK',FILE='PHYSIN.IN1')
      OPEN(UNIT=9,DEVICE='DSK',FILE='PHYSIN.IN2')
      OPEN(UNIT=10,DEVICE='DSK',FILE='PHYSIN.OUT')
      OPEN(UNIT=11,DEVICE='DSK',FILE='IMPACT.OUT')
C
C     INPUT ROUTINE
C
      NI=13

      READ(8,1) TITLE
1     FORMAT(A10)
      READ(8,7) UNIT
7     FORMAT(A3)
      READ(8,2)(PI(I),I=1,NI)
2     FORMAT(3X,8F9.0/3X,5F9.0)
      READ(9,3)(OUTPUT(I),I=1,NI)
3     FORMAT(3X,8F9.0/3X,5F9.0)
      READ(11,4)(NEWOUT(I),I=1,NI)
4     FORMAT(3X,8F9.1/3X,5F9.1)
      DO 5 I=1,NI
5     READ(11,6)(FINAL(I,J),J=1,5)
6     FORMAT(3X,5F9.1)
C
C     CALCULATION ROUTINE
C
      DO 12 I=1,NI
      OUTPUT(I)=OUTPUT(I)*1000.
12    NEWOUT(I)=NEWOUT(I)*1000.
      DO 10 I=1,NI
10    PIPDGO(I)=PI(I)/OUTPUT(I)
      DO 11 I=1,NI
11    NEWPI(I)=PIPDGO(I)*NEWOUT(I)
      DO 13 I=1,NI
13    NEWOUT(I)=NEWOUT(I)/1000.
C
C     OUTPUT ROUTINE
C
      WRITE(10,50)
50    FORMAT('1',51X,'PHYSICAL INPUT REQUIREMENTS')
      WRITE(10,51) TITLE
51    FORMAT('0',74X,'GROSS FIXED',35X,A10)
      WRITE(10,52)
52    FORMAT(' ',76X,'CAPITAL',24X,'GROSS',10X,'INPUT')
      WRITE(10,53)
53    FORMAT(' INDUSTRY',21X,'INVENTORIES',6X,'EXPORTS',7X,'GOVERNMENT',
     1 5X,'FORMATION',5X,'CONSUMPTION',7X,'OUTPUT',6X,'REQUIREMENT')
      WRITE(10,54) UNIT
54    FORMAT(' ',23X,6(8X,'($''000)'),9X,'(',A3,')')
      WRITE(10,60) (FINAL(1,J),J=1,5), NEWOUT(1), NEWPI(1)
60    FORMAT('-HARD-ROCK MINING',6X,7F15.1)
      WRITE(10,61) (FINAL(2,J),J=1,5), NEWOUT(2), NEWPI(2)
61    FORMAT('-PLACER MINING',9X,7F15.1)
      WRITE(10,62) (FINAL(3,J),J=1,5), NEWOUT(3), NEWPI(3)
62    FORMAT('-OIL AND GAS',11X,7F15.1)
      WRITE(10,64) (FINAL(4,J),J=1,5), NEWOUT(4), NEWPI(4)
64    FORMAT('-FORESTRY',14X,7F15.1)
```

```
      WRITE(10,63)
63    FORMAT('0FISHING, HUNTING, TRAPPING')
      WRITE(10,65) (FINAL(5,J),J=1,5), NEWOUT(5), NEWPI(5)
65    FORMAT(' AND SUBSISTENCE',7X,7F15.1)
      WRITE(10,66) (FINAL(6,J),J=1,5), NEWOUT(6), NEWPI(6)
66    FORMAT('-TRANSPORTATION',8X,7F15.1)
      WRITE(10,67) (FINAL(7,J),J=1,5), NEWOUT(7), NEWPI(7)
67    FORMAT('-CONSTRUCTION',10X,7F15.1)
      WRITE(10,68) (FINAL(8,J),J=1,5), NEWOUT(8), NEWPI(8)
68    FORMAT('-UTILITIES',13X,7F15.1)
      WRITE(10,69) (FINAL(9,J),J=1,5), NEWOUT(9), NEWPI(9)
69    FORMAT('-WHOLESALE TRADE',7X,7F15.1)
      WRITE(10,70) (FINAL(10,J),J=1,5), NEWOUT(10), NEWPI(10)




70    FORMAT('-RETAIL TRADE',10X,7F15.1)
      WRITE(10,72) (FINAL(11,J),J=1,5), NEWOUT(11), NEWPI(11)
72    FORMAT('-SERVICES',14X,7F15.1)
      WRITE(10,71)
71    FORMAT('0FINANCE, INSURANCE')
      WRITE(10,73) (FINAL(12,J),J=1,5), NEWOUT(12), NEWPI(12)
73    FORMAT(' AND REAL ESTATE',7X,7F15.1)
      WRITE(10,74) (FINAL(13,J),J=1,5), NEWOUT(13), NEWPI(13)
74    FORMAT('-MANUFACTURING',9X,7F15.1)
      WRITE(10,75)
75    FORMAT('1')
      STOP
      END
```

PHYSIN.IN1

This input file contains information on specified input requirements in a base year by industries 1 to 13.

```
ELECTRICAL
KWH
     101040.      500.      100.   10000.      150.      110.     3000.     1000.
       1500.     5000.    15000.     900.     1000.
```

PHYSIN.IN2

This input file contains base year gross outlays by industry.

```
 150593.    2966.        0.      207.    4630.   54246.   74551.  20397.
  66612.   66723.   65719.   43651.    7073.
```

IMPACT.OUT

This output of IMPACN.FOR contains total outlays of industries 1 to 13 and final demand values of 5 sectors for output of industries 1 to 13.

```
NO  150591.    2967.       0.     207.    4630.  54247.   74550.   20398.
     66612.   66723.   65719.   43651.    7073.
 1   17378.  133213.       0.       0.       0.
 2       0.    1321.       0.       0.       0.
 3       0.       0.       0.       0.       0.
 4       0.       0.      12.       0.       0.
 5       0.     934.       0.       0.    3696.
 6       0.       0.    2392.       0.       0.
 7       0.       0.    2116.   10475.       0.
 8       0.     665.     219.       0.    6605.
 9       0.       0.   22992.   23438.       0.
10       0.   22091.    6177.       0.   32311.
11       0.   12074.    1993.       0.   19555.
12       0.    1268.       0.       0.   11444.
13       0.       0.     594.       0.       0.
```

PHYSIN.OUT

Output of PHYSIN.FOR shows physical input requirements by industry.

```
1
0                                        PHYSICAL INPUT REQUIREMENTS
                                                                GROSS FIXED                                 ELECTRICAL
 INDUSTRY                                                         CAPITAL                      GROSS           INPUT
                           INVENTORIES      EXPORTS    GOVERNMENT FORMATION  CONSUMPTION       OUTPUT      REQUIREMENT
                             ($'000)        ($'000)     ($'000)     ($'000)     ($'000)        ($'000)        (KWH)
-HARD-ROCK MINING             1760.0       207425.0        0.0         0.0         0.0       209185.0       140352.2
-PLACER MINING                   0.0          0.0          0.0         0.0         0.0         2065.0          348.1
-OIL AND GAS                     0.0      10445.0          0.0         0.0         0.0        10445.0****************
-FORESTRY                        0.0          0.0         99.0         0.0         0.0          371.0        17922.7
0FISHING, HUNTING, TRAPPING
 AND SUBSISTENCE                 0.0       5738.0          0.0         0.0     20335.0        26071.0          844.7
-TRANSPORTATION                  0.0          0.0       2153.0         0.0         0.0        75208.0          152.5
-CONSTRUCTION                    0.0          0.0       1921.0     19687.0         0.0       115113.0         4632.3
-UTILITIES                       0.0        896.0        199.0         0.0     15395.0        35184.0         1725.0
-WHOLESALE TRADE                 0.0          0.0      20436.0     20406.0         0.0        72035.0         1622.1
-RETAIL TRADE                    0.0      26853.0       5995.0         0.0     80399.0       126322.0         9466.2
-SERVICES                        0.0       6514.0       1789.0         0.0     31302.0        38387.0        20173.8
0FINANCE, INSURANCE
 AND REAL ESTATE                 0.0       1621.0          0.0         0.0     21254.0        70149.0         1446.3
-MANUFACTURING                   0.0          0.0        530.0         0.0         0.0        10037.0         1419.1
1
```